

**UTAH**  
**State Implementation Plan**

**Control Measures for Area and Point Sources, Fine Particulate Matter,  
PM<sub>2.5</sub> SIP for the Salt Lake City, UT Nonattainment Area**

**Section IX. Part A.21**

Adopted by the Utah Air Quality Board

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Acronyms .....3  
Table of Contents .....5  
List of Figures .....7  
List of Tables ..... 9

## Acronyms

BACT	Best Available Control Technology
CAA	Clean Air Act
CFR	Code of Federal Regulations
CMAQ	Community Multiscale Air Quality
CTG	Control Techniques Guideline Documents
DAQ	Utah Division of Air Quality (also UDAQ)
EPA	Environmental Protection Agency
FRM	Federal Reference Method
MACT	Maximum Available Control Technology
MATS	Model Attainment Test Software
MPO	Metropolitan Planning Organization
$\mu\text{g}/\text{m}^3$	Micrograms Per Cubic Meter
Micron	One Millionth of a Meter
NAAQS	National Ambient Air Quality Standards
NESHAP	National Emissions Standards for Hazardous Air Pollutants
$\text{NH}_3$	Ammonia
$\text{NO}_x$	Nitrogen Oxides
NSPS	New Source Performance Standard
NSR	New Source Review
PM	Particulate Matter
$\text{PM}_{10}$	Particulate Matter Smaller Than 10 Microns in Diameter
$\text{PM}_{2.5}$	Particulate Matter Smaller Than 2.5 Microns in Diameter

RACM	Reasonably Available Control Measures
RACT	Reasonably Available Control Technology
RFP	Reasonable Further Progress
SIP	State Implementation Plan
SMOKE	Sparse Matrix Operator Kernel Emissions
SO <sub>2</sub>	Sulfur Dioxide
SO <sub>x</sub>	Sulfur Oxides
TSD	Technical Support Document
VOC	Volatile Organic Compounds
UAC	Utah Administrative Code
WRF	Weather Research and Forecasting

# TABLE OF CONTENTS

## Chapter 1 – INTRODUCTION AND BACKGROUND

1.1 Fine Particulate Matter .....	11
1.2 Health and Welfare Impacts of PM <sub>2.5</sub> .....	11
1.3 Fine Particulate Matter in Utah .....	12
1.4 2006, NAAQS for PM <sub>2.5</sub> .....	12
1.5 PM <sub>2.5</sub> Nonattainment Areas in Utah .....	13
1.6 PM <sub>2.5</sub> Precursors .....	14

## Chapter 2 – REQUIREMENTS FOR 2006, PM<sub>2.5</sub> PLAN REVISIONS

2.1 Requirements for Nonattainment SIPs .....	16
2.2 PM <sub>2.5</sub> SIP Guidance .....	17
2.3 Summary of this SIP Proposal .....	17

## Chapter 3 – AMBIENT AIR QUALITY DATA

3.1 Measuring Fine Particle Pollution in the Atmosphere .....	18
3.2 Utah’s Air Monitoring Network.....	18
3.3 Annual PM <sub>2.5</sub> – Mean Concentrations.....	19
3.4 Daily PM <sub>2.5</sub> – Averages of 98 <sup>th</sup> Percentiles and Design Values .....	20
3.5 Composition of Fine Particle Pollution – Speciated Monitoring Data .....	21
3.6 PCAP Study .....	24
3.7 Ammonia (NH <sub>3</sub> ) Studies .....	24

## Chapter 4 - EMISSION INVENTORY DATA

4.1 Introduction .....	25
4.2 The 2008 Emissions Inventory.....	26
4.3 Characterization of Utah’s Airsheds .....	26

**Chapter 5 – ATTAINMENT DEMONSTRATION**

**5.1 Introduction .....29**

**5.2 Photochemical Modeling .....29**

**5.3 Domain/Grid Resolution .....29**

**5.4 Episode Selection .....30**

**5.5 Meteorological Data .....33**

**5.6 Photochemical Model Performance Evaluation .....34**

**5.7 Summary of Model Performance .....41**

**5.8 Modeled Attainment Test .....42**

**5.9 Air Quality as of the Attainment Date .....43**

**Chapter 6 – CONTROL MEASURES**

**6.1 Introduction .....44**

**6.2 Utah Stakeholder Workgroup Efforts .....44**

**6.3 Identification of Measures .....45**

**6.4 Existing Control Measures .....46**

**6.5 SIP Controls .....54**

**6.6 Reasonably Available Control Measures (RACM/RACT) .....54**

**Chapter 7 – TRANSPORTATION CONFORMITY**

**7.1 Introduction .....64**

**7.2 Consultation .....64**

**7.3 Regional Emission Analysis .....65**

**7.4 Interim PM<sub>2.5</sub> Conformity Test .....66**

**Chapter 8 – REASONABLE FURTHER PROGRESS**

**8.1 Introduction .....67**

**8.2 Moderate Area Planning Requirements .....67**

**8.3 RFP for the Salt Lake City, UT Nonattainment Area .....68**

**Chapter 9 – CONTINGENCY MEASURES**

**9.1 Background .....71**

**9.2 Contingency Measures and Implementation Schedules for the Nonattainment Area .....71**

**9.3 Conclusions .....72**

## List of Figures

Figure 1.1, Nonattainment Areas for the 2006, PM <sub>2.5</sub> NAAQS .....	13
Figure 3.1, Utah’s PM <sub>2.5</sub> Air Monitoring Network .....	19
Figure 5.1: Northern Utah photochemical modeling domain.....	30
Figure 5.2: Hourly PM <sub>2.5</sub> concentrations for January 11-20, 2007 .....	31
Figure 5.3: Hourly PM <sub>2.5</sub> concentrations for February 14-19, 2008 .....	32
Figure 5.4: 24-hour average PM <sub>2.5</sub> concentrations for December-January, 2009-10. ....	33
Figure 5.5: UDAQ monitoring network.....	34
Figure 5.6: Spatial plot of CMAQ modeled 24-hr PM <sub>2.5</sub> (µg/m <sup>3</sup> ) for 2010 Jan. 03.....	35
Figure 5.7: 24-hr PM <sub>2.5</sub> time series (Hawthorne). Observed 24-hr PM <sub>2.5</sub> (blue trace) and CMAQ modeled 24-hr PM <sub>2.5</sub> (red trace). ....	36
Figure 5.8: 24-hr PM <sub>2.5</sub> time series (Ogden). Observed 24-hr PM <sub>2.5</sub> (blue trace) and CMAQ modeled 24-hr PM <sub>2.5</sub> (red trace).....	37
Figure 5.9: 24-hr PM <sub>2.5</sub> time series (Lindon). Observed 24-hr PM <sub>2.5</sub> (blue trace) and CMAQ modeled 24-hr PM <sub>2.5</sub> (red trace).....	37
Figure 5.10: 24-hr PM <sub>2.5</sub> time series (Logan). Observed 24-hr PM <sub>2.5</sub> (blue trace) and CMAQ modeled 24-hr PM <sub>2.5</sub> (red trace).....	38
Figure 5.11: An example of the Salt Lake Valley at the end of a high PM <sub>2.5</sub> episode.....	38
Figure 5.12: The composition of observed and model simulated average 24-hr PM <sub>2.5</sub> speciation averaged over days when an observed and modeled day had 24-hr concentrations > 35 µg/m <sup>3</sup> at the Hawthorne STN site.....	39
Figure 5.13: The composition of observed and model simulated average 24-hr PM <sub>2.5</sub> speciation averaged over days when an observed and modeled day had 24-hr concentrations > 35 µg/m <sup>3</sup> at the Bountiful STN site. ....	40
Figure 5.14: The composition of observed and model simulated average 24-hr PM <sub>2.5</sub> speciation averaged over days when an observed and modeled day had 24-hr concentrations > 35 µg/m <sup>3</sup> at the Lindon STN site. ....	40

Figure 5.15: The composition of model simulated average 24-hr PM<sub>2.5</sub> speciation averaged over days when a modeled day had 24-hr concentrations > 35 µg/m<sup>3</sup> at the Logan monitoring site. No observed speciation data is available for Logan. .... 41

Figure 5.16, Model Results for the Salt Lake City, UT Nonattainment Area ..... 42

## LIST OF TABLES

Table 3.1, PM <sub>2.5</sub> Annual Mean Concentrations .....	20
Table 3.2, 24-hour PM <sub>2.5</sub> Monitored Design Values .....	21
Table 4.1, Emissions Summary for 2010 (SMOKE). Emissions are presented in tons per average winter day. ....	27
Table 4.2, Emissions Summaries for the Salt Lake City, UT Nonattainment Area; Baseline, RFP and Attainment Years (SMOKE). Emissions are presented in tons per average winter day. ....	28
Table 5.1, Modeled Concentrations (µg/m <sup>3</sup> ) for the Salt Lake City, UT Nonattainment Area .....	43
Table 6.1, Tier 1 Emission Standards .....	49
Table 6.2, Tier 2 Emission Standards .....	51
Table 6.3, Point Source Emissions; Baseline and Projections with Growth and Control .....	57
Table 6.4 Area Source Strategy Screening.....	59
Table 6.5, Emissions Reductions from Area Source SIP Controls .....	62
Table 8.1, Reasonable Further Progress in the Salt Lake City, UT nonattainment area .....	69

## Chapter 1 – INTRODUCTION AND BACKGROUND

### 1.1 Fine Particulate Matter

According to EPA's website, particulate matter, or PM, is a complex mixture of extremely small particles and liquid droplets. Particulate matter is made up of a number of components, including acids (such as nitrates and sulfates), organic chemicals, metals, and soil or dust particles.

The size of particles is directly linked to their potential for causing health problems. EPA is concerned about particles that are 10 micrometers in diameter or smaller because those are the particles that generally pass through the throat and nose and enter the lungs. Once inhaled, these particles can affect the heart and lungs and cause serious health effects. Other negative effects are reduced visibility and accelerated deterioration of buildings.

EPA groups particle pollution into two categories:

- "Inhalable coarse particles," such as those found near roadways and dusty industries, are larger than 2.5 micrometers and smaller than 10 micrometers in diameter. Utah has previously addressed inhalable coarse particles as part of its PM<sub>10</sub> SIPs for Salt Lake and Utah Counties, but this fraction is not measured as PM<sub>2.5</sub> and will not be a subject for this nonattainment SIP.
- "Fine particles," such as those found in smoke and haze, are 2.5 micrometers in diameter and smaller and thus denoted as PM<sub>2.5</sub>. These particles can be directly emitted from sources such as forest fires, or they can form when gases emitted from power plants, industries and automobiles react in the air.

PM concentration is reported in micrograms per cubic meter or  $\mu\text{g}/\text{m}^3$ . The particulate is collected on a filter and weighed. This weight is combined with the known amount of air that passed through the filter to determine the concentration in the air.

### 1.2 Health and Welfare Impacts of PM<sub>2.5</sub>

Numerous scientific studies have linked particle pollution exposure to a variety of problems, including:

- increased respiratory symptoms, such as irritation of the airways, coughing, or difficulty breathing, for example;
- decreased lung function;
- aggravated asthma;
- development of chronic bronchitis;
- irregular heartbeat;

- nonfatal heart attacks; and
- pre-mature death in people with heart or lung disease.

People with heart or lung diseases, children and older adults are the most likely to be affected by particle pollution exposure. However, even healthy people may experience temporary symptoms from exposure to elevated levels of particle pollution.

### **1.3 Fine Particulate Matter in Utah**

Excluding wind-blown desert dust events, wild land fires, and holiday related fireworks, elevated PM<sub>2.5</sub> in Utah occurs when stagnant cold pools develop during the winter season.

The synoptic conditions that lead to the formation of cold pools in Utah's nonattainment areas are: synoptic scale ridging, subsidence, light winds, snow cover (often), and cool- to-cold surface temperatures. These conditions occur during winter months, generally mid-November through early March.

During a winter-time cold pool episode, emissions of PM<sub>2.5</sub> precursors react relatively quickly to elevate overall concentrations, and of course dispersion is very poor due to the very stable air mass. Episodes may last from a few days to tens of days when meteorological conditions change to once again allow for good mixing.

The scenario described above leads to exceedances and violations of the 24-hour health standard for PM<sub>2.5</sub>. In other parts of the year concentrations are generally low, and even with the high peaks incurred during winter, are well within the annual health standard for PM<sub>2.5</sub>.

### **1.4 2006, NAAQS for PM<sub>2.5</sub>**

In September of 2006, EPA revised the (1997) standards for PM<sub>2.5</sub>. While the annual standard remained unchanged at 15 µg/m<sup>3</sup>, the 24-hr standard was lowered from 65 µg/m<sup>3</sup> to 35 µg/m<sup>3</sup>.

DAQ has monitored PM<sub>2.5</sub> since 2000, and found that all areas within the state have been in compliance with the 1997 standards. At this new 2006 level, all or parts of five counties have collected monitoring data that is not in compliance with the 24-hr standard.

In 2013, EPA lowered the annual average to 12 µg/m<sup>3</sup>. Monitoring data shows no instances of noncompliance with this revised standard.

## 1.5 PM<sub>2.5</sub> Nonattainment Areas in Utah

There are two distinct nonattainment areas for the 2006, PM<sub>2.5</sub> standards residing entirely within the state of Utah. These are the Salt Lake City, UT, and Provo, UT nonattainment areas, which together encompass what is referred to as the Wasatch Front. A third nonattainment area is more or less geographically defined by the Cache Valley which straddles the border between Utah and Idaho (the Logan, UT – ID nonattainment area.) Figure 1.1 below shows the geographic extent of these areas.

None of these three areas has violated the annual NAAQS for PM<sub>2.5</sub>. Without exception, the exceedances leading to 24-hr NAAQS violations are associated with relatively short-term meteorological occurrences.

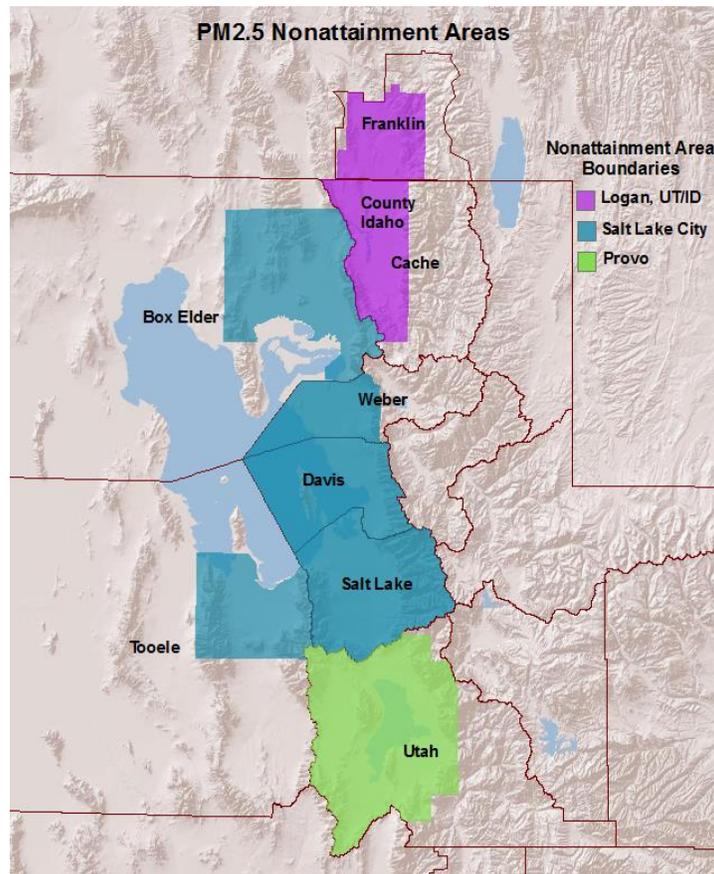


Figure 1.1, Nonattainment Areas for the 2006, PM<sub>2.5</sub> NAAQS

Each of these three areas was designated, by the EPA, based on the weight of evidence of the following nine factors recommended in its guidance and any other relevant information:

- pollutant emissions
- air quality data
- population density and degree of urbanization
- traffic and commuting patterns
- growth
- meteorology
- geography and topography
- jurisdictional boundaries
- level of control of emissions sources

EPA also used analytical tools and data such as pollution roses, fine particulate composition monitoring data, back trajectory analyses, and the contributing emission score (CES) to evaluate these areas.

While the general meteorological characteristics are identical between the Wasatch Front and Cache Valley, there are two important differences related to topography. First, the Cache Valley is a closed basin while the Wasatch Front has many large outlets that connect it to the larger Great Basin. The large outlets along the Wasatch Front provide the potential for greater advection of pollutants and for a potentially weaker cold pool. Second, the Cache Valley is a narrow (<20 km) valley bordered by extremely steep mountains. These topographical differences lead to faster forming, more intense, and more persistent cold pools in Cache Valley relative to the Wasatch Front.

Because of these differences, the two Wasatch Front areas and the Cache Valley are designated as separate nonattainment areas; however, they have all been modeled together within the same modeling domain.

## **1.6 PM<sub>2.5</sub> Precursors**

The majority of ambient PM<sub>2.5</sub> collected during a typical cold-pool episode of elevated concentration is secondary particulate matter, born of precursor emissions. The precursor gasses associated with fine particulate matter are SO<sub>2</sub>, NO<sub>x</sub>, volatile organic compounds (VOC), and ammonia (NH<sub>3</sub>).

Clean Air Act Section 189(e) requires that the control requirements applicable in plans for major stationary sources of PM<sub>10</sub> shall also apply to major stationary sources of PM<sub>10</sub> precursors, except where the Administrator determines that such sources do not contribute significantly to PM<sub>10</sub> levels which exceed the standard in the area.

As this paragraph now applies also to PM<sub>2.5</sub> plans the following should be said about the way this plan is structured.

CAA Section 172 does not include any specific applicability thresholds to identify the size of sources that States and EPA must consider in the plan's RACT and RACM analysis. In developing the emissions inventories underlying the SIP, the criteria of 40 CFR 51 for air emissions reporting requirements was used to establish a 100 ton per year threshold for identifying a sub-group of stationary point sources that would be evaluated individually. For the Salt Lake City, UT nonattainment area, there are 28 stationary point sources that met or meet the criteria of 100 tons per year for PM<sub>2.5</sub> or any PM<sub>2.5</sub> precursor.

The control evaluations for each of these sources included PM<sub>2.5</sub> as well as PM<sub>2.5</sub> precursors. This principle was extended to the non-stationary source categories as well.

When evaluating the cost per ton necessary to reduce emissions, consideration was given to the resulting PM<sub>2.5</sub> concentrations. Through this process, reasonable controls were identified affecting PM<sub>2.5</sub>, SO<sub>2</sub>, NO<sub>x</sub> and VOC.

No such controls were identified for ammonia. Ammonia occurs in such abundance that PM<sub>2.5</sub> concentrations are not sensitive to reductions in ammonia unless those reductions are very large. Within the stationary source category, there really were no significant amounts of ammonia to evaluate. The largest contributor to the ammonia inventory was the agricultural sector, and the maximum possible amount of ammonia reduction from that sector would still not be enough to affect a reduction in PM<sub>2.5</sub>.

Additional information regarding control measures may be found in Chapter 6 as well as the Technical Support Document (TSD).

## Chapter 2 – REQUIREMENTS FOR 2006, PM<sub>2.5</sub> PLAN REVISIONS

### 2.1 Requirements for Nonattainment SIPs

Section 110 of the Clean Air Act lists the requirements for implementation plans. Many of these requirements speak to the administration of an air program in general. Section 172 of the Act contains the plan requirements for nonattainment areas. Some of the more notable requirements identified in these sections of the Act that pertain to this SIP include:

- Implementation of Reasonably Available Control Measures (RACM) as expeditiously as practicable
- Reasonable Further Progress (RFP) toward attainment of the National Ambient Air Quality Standards by the applicable attainment date
- Enforceable emission limits as well as schedules for compliance
- A comprehensive inventory of actual emissions
- Contingency measures to be undertaken if the area fails to make reasonable further progress or attain the NAAQS by the applicable attainment date

On January 4, 2013, D.C. Circuit Court of Appeals found that EPA had incorrectly interpreted the Clean Air Act when determining how to implement the National Ambient Air Quality Standards (NAAQS) for PM<sub>2.5</sub>. The January 4, 2013 court ruling held that the EPA should have implemented the PM<sub>2.5</sub> NAAQS based on *both* Clean Air Act (CAA) Subpart 1 (“Nonattainment Areas in General” of “Part D – Plan Requirements for Nonattainment Areas”) *and* Subpart 4 (“Additional Provisions for Particulate Matter Nonattainment Areas”) of Part D, title 1. EPA had (incorrectly) required states to develop their SIPs based only on Subpart 1. Therefore, as of January 4, 2013, Subpart 4 also applies.

Under Subpart 4, nonattainment areas for particulate matter may carry the classification of either moderate or serious. Subpart 4 addresses the attainment dates and planning provisions for both moderate and serious PM nonattainment areas.

In the wake of the decision by the D.C. Circuit, EPA has promulgated a “Deadlines Rule” that identifies each of Utah’s three PM<sub>2.5</sub> nonattainment areas as moderate. It specifies December 31, 2014 as the SIP submission deadline for these moderate PM<sub>2.5</sub> nonattainment areas, and further specifies December 31, 2015 as the attainment date for each area.

More specific requirements for the preparation, adoption, and submittal of implementation plans are specified in 40 CFR Part 51. Subpart Z of Part 51 had contained provisions for Implementation of PM<sub>2.5</sub> National Ambient Air Quality Standards. However, one consequence of the January 4, 2013 Court ruling was to revoke Subpart Z. This leaves only the more general requirements of Part 51.

## **2.2 PM<sub>2.5</sub> SIP Guidance**

Beyond what had been codified in Subpart Z of Part 51 concerning the Implementation of the PM<sub>2.5</sub> NAAQS, EPA had provided additional clarification and guidance in its Clean Air Particulate Implementation Rule for the 1997, PM<sub>2.5</sub> NAAQS (FR 72, 20586) and its subsequent Implementation Guidance for the 2006, 24-Hour Fine Particle NAAQS (March 2, 2012). This too was revoked by the D.C. Circuit Court's decision. Until such time as a new implementation rule for PM<sub>2.5</sub> is promulgated, the Deadlines Rule recommends the General Preamble, EPA's longstanding general guidance that interprets the 1990 amendments to the CAA, as the applicable guidance for states to follow while preparing SIPs for PM<sub>2.5</sub> nonattainment areas.

## **2.3 Summary of this SIP Proposal**

This implementation plan was developed to meet the requirements specified in the law, rule, and appropriate guidance documents identified above. Discussed in the following chapters are: air monitoring, reasonably available control measures, modeled attainment demonstration, emission inventories, reasonable further progress toward attainment, transportation conformity, and contingency measures. Additional information is provided in the technical support document (TSD).

## Chapter 3 – Ambient Air Quality Data

### 3.1 Measuring Fine Particle Pollution in the Atmosphere

Utah has monitored PM<sub>2.5</sub> in its airsheds since 2000 following the promulgation of the 1997, PM<sub>2.5</sub> NAAQS which was set at 65 µg/m<sup>3</sup> for a 24-hour averaging period. PM<sub>2.5</sub> monitoring sites were initially located based on concentrations of PM<sub>10</sub>, which historically were measured at sites located based on emissions of primary particles. PM<sub>2.5</sub> concentrations, especially during Utah's wintertime valley temperature inversions, tend to be distributed more homogeneously within a specific airshed. Homogeneity of PM<sub>2.5</sub> concentrations means that one or two monitors are adequate to determine compliance with the NAAQS in specific airsheds. DAQ's monitors are appropriately located to assess concentration, trends, and changes in PM<sub>2.5</sub> concentrations. During Utah's wintertime cold-pool episodes, every day sampling and real time monitoring are needed for modeling and public notification.

### 3.2 Utah's Air Monitoring Network

The Air Monitoring Center (AMC) maintains an ambient air monitoring network in Utah that collects both air quality and meteorological data. Figure 3.1 shows the location of sites along the Wasatch Front that collect PM<sub>2.5</sub> data. Twelve sites collect PM<sub>2.5</sub> data using the Federal Reference Method (FRM); PM<sub>2.5</sub> is collected on filters over a 24 hour period and its mass is measured gravimetrically. Seven of those sites also measure PM<sub>2.5</sub> concentrations continuously in real-time. Real-time PM<sub>2.5</sub> data is useful both for pollution forecasting and to compare with 24-hour concentrations of PM<sub>2.5</sub> collected on filters. Of the twelve sites that use the FRM to measure PM<sub>2.5</sub>, six sites collect PM<sub>2.5</sub> data daily and six sites collect PM<sub>2.5</sub> data on every third day. Three sites along the Wasatch Front collect speciated PM<sub>2.5</sub>. Particulate matter on the speciated PM<sub>2.5</sub> filters is analyzed for organic and inorganic carbon and a list of 48 elements. PM<sub>2.5</sub> speciation data is particularly useful in helping to identify sources of particulate matter. The ambient air quality monitoring network along Utah's Wasatch Front and in the Cache Valley meets EPA requirements for monitoring networks.

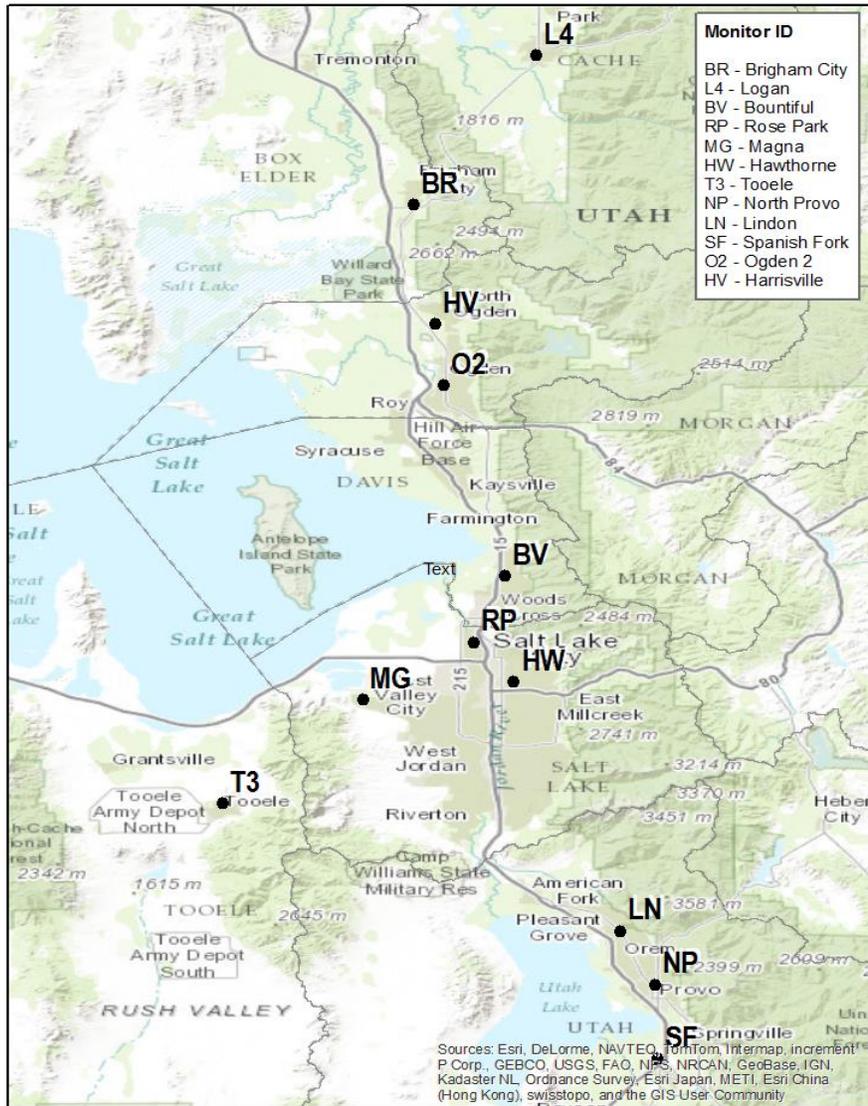


Figure 3.1, Utah's PM<sub>2.5</sub> Air Monitoring Network

### 3.3 Annual PM<sub>2.5</sub> – Mean Concentrations

The procedure for evaluating PM<sub>2.5</sub> data with respect to the NAAQS is specified in Appendix N to 40 CFR Part 50. Generally speaking, the annual PM<sub>2.5</sub> standard is met when a three-year average of annual

mean values is less than or equal to 12.0  $\mu\text{g}/\text{m}^3$ . Each annual mean is itself an average of four quarterly averages.

Table 3.1, below shows the running 3-year averages of annual mean values for each of Utah’s monitoring locations. The data in the table spans the years 2008 through 2012. These are the years surrounding 2010, the year for which the baseline modeling inventory was prepared. It can be seen from the data that there are no locations at which the annual NAAQS was violated. It should be noted that the conclusion would be no different if the most recent data from 2013 were considered.

Location	County	3-Year Average of Annual Mean Concentrations		
		08 - 10	09 - 11	10 - 12
Logan (Combined POC 1 & 2)	Cache	10.0	9.7	8.7
Brigham City	Box Elder	8.3	8.2	7.7
Ogden 2 (POC 1)	Weber	9.7	9.5	9.1
Harrisville	Weber	8.6	8.3	7.6
Bountiful	Davis	9.8	9.2	8.3
Rose Park (POC 1)	Salt Lake	10.4	9.7	9.2
Magna	Salt Lake	8.5	8.4	7.7
Hawthorn (POC 1)	Salt Lake	10.4	9.7	8.8
Tooele	Tooele	6.8	6.8	6.3
Lindon (POC 1)	Utah	9.8	9.1	8.3
North Provo	Utah	9.4	8.7	8.1
Spanish Fork	Utah	8.8	8.5	7.7

**Table 3.1, PM<sub>2.5</sub> Annual Mean Concentrations**

### 3.4 Daily PM<sub>2.5</sub> – Averages of 98<sup>th</sup> Percentiles and Design Values

The procedure for evaluating PM<sub>2.5</sub> data with respect to the NAAQS is specified in Appendix N to 40 CFR Part 50. Generally speaking, the 24-hr. PM<sub>2.5</sub> standard is met when a three-year average of 98<sup>th</sup> percentile values is less than or equal to 35  $\mu\text{g}/\text{m}^3$ . Each year’s 98<sup>th</sup> percentile is the daily value below which 98% of all daily values fall.

Table 3.2, below shows the running 3-year averages of 98<sup>th</sup> percentile values for each of Utah’s monitoring locations. Again, the data in the table spans the years 2008 through 2012 which are the years surrounding 2010, the baseline modeling inventory. It can be seen from the data that there are many locations at which the 24-hr. NAAQS has been violated, and this SIP has been structured to specifically address the 24-hr. standard.

Site-Specific Baseline Design Values:		3-Year Average of 98th Percentiles			Baseline Design Value
Location	County	08 - 10	09 - 11	10 - 12	
Logan (Combined POC 1 & 2)	Cache	42.6	42.4	37.2	40.7
Brigham City	Box Elder	42.5	40.1	37.2	39.9
Ogden 2 (POC 1)	Weber	37.0	41.1	37.4	38.5
Harrisville	Weber	35.6	36.6	33.2	35.1
Bountiful	Davis	37.7	40.3	34.4	37.5
Rose Park (POC 1)	Salt Lake	40.9	40.7	35.4	39.0
Magna	Salt Lake	32.8	34.5	30.3	32.5
Hawthorn (POC 1)	Salt Lake	43.6	44.5	38.1	42.1
Tooele	Tooele	25.9	27.1	24.4	25.8
Lindon (POC 1)	Utah	40.5	40.9	32.4	37.9
North Provo	Utah	36.4	35.1	28.6	33.4
Spanish Fork	Utah	39.3	41.7	34.6	38.5

**Table 3.2, 24-hour PM<sub>2.5</sub> Monitored Design Values**

As mentioned in the foregoing paragraph, this SIP is structured to address the 24-hr. PM<sub>2.5</sub> NAAQS. As such the modeled attainment test must consider monitored baseline design values from each of these locations. EPA’s modeling guidance<sup>1</sup> recommends this be calculated using three-year averages of the 98<sup>th</sup> percentile values. To calculate the monitored baseline design value, EPA recommends an average of three such three-year averages that straddle the baseline inventory. 2010 is the year represented by the baseline inventory. Therefore, the three-year average of 98<sup>th</sup> percentile values collected from 2008-2010 would be averaged together with the three-year averages for 2009-2011 and 2010-2012 to arrive at the site-specific monitored baseline design values. These values are also shown in Table 3.2<sup>2</sup>.

### 3.5 Composition of Fine Particle Pollution – Speciated Monitoring Data

DAQ operates three PM<sub>2.5</sub> speciation sites. The Hawthorne site in Salt Lake County is one of 54 Speciation Trends Network (STN) sites operated nationwide on an every-third-day sampling schedule. Sites at Bountiful/Viewmont in Davis County and Lindon in Utah County are State and Local Air

<sup>1</sup> Guidance on the Use of Models and Other Analyses for Demonstrating Attainment of Air Quality Goals for Ozone, PM<sub>2.5</sub>, and Regional Haze (EPA -454B-07-002, April 2007)

<sup>2</sup> Recalculating the design values by replacing the 98<sup>th</sup> percentiles from 2008 with the most recent 98<sup>th</sup> percentiles from 2013 has a mixed effect throughout the monitoring network, with some sites increasing and others decreasing. The design value for Hawthorne, the controlling monitor, would decrease by 0.8 µg/m<sup>3</sup>. This decrease is not significant enough to change the conclusion drawn in Section 5.9.

Monitoring Stations (SLAMS) PM<sub>2.5</sub> speciation sites that operate on an every-sixth-day sampling schedule.

Filters are prepared by the EPA contract laboratory and shipped to Utah for sampling. Samples are collected for particulate mass, elemental analysis, identification of major cations and anions, and concentrations of elemental and organic carbon as well as crustal material present in PM<sub>2.5</sub>. Carbon sampling and analysis changed in 2007 to match the Interagency Monitoring of Protected Visual Environments (IMPROVE) method using a modified IMPROVE sampler at all sites.

The PM<sub>2.5</sub> is collected on three types of filters: Teflon, nylon, and quartz. Teflon filters are used to characterize the inorganic contents of PM<sub>2.5</sub>. Nylon filters are used to quantify the amount of ammonium nitrate, and quartz filters are used to quantify the organic and inorganic carbon content in the ambient PM<sub>2.5</sub>.

Data from the speciation network show the importance of volatile secondary particulates during the colder months. These particles are significantly lost in FRM PM<sub>2.5</sub> sampling.

During the winter periods between 2009 and 2011, DAQ conducted special winter speciation studies aimed at better characterization of PM<sub>2.5</sub> during the high pollution episodes. These studies were accomplished by shifting the sampling of the Chemical Speciation Network monitors to 1-in-2-day schedule during the months of January and February. Speciation monitoring during the winter high-pollution episodes produced similar results in PM<sub>2.5</sub> composition each year.

The results of the speciation studies lead to the conclusion that the exceedances of the PM<sub>2.5</sub> NAAQS are a result of the increased portion of the secondary PM<sub>2.5</sub> that was chemically formed in the air and not primary PM<sub>2.5</sub> emitted directly into the troposphere.

Figure 3.2 below shows the contribution of the identified compounds from the speciation sampler both during a winter temperature inversion period and during a well-mixed winter period.

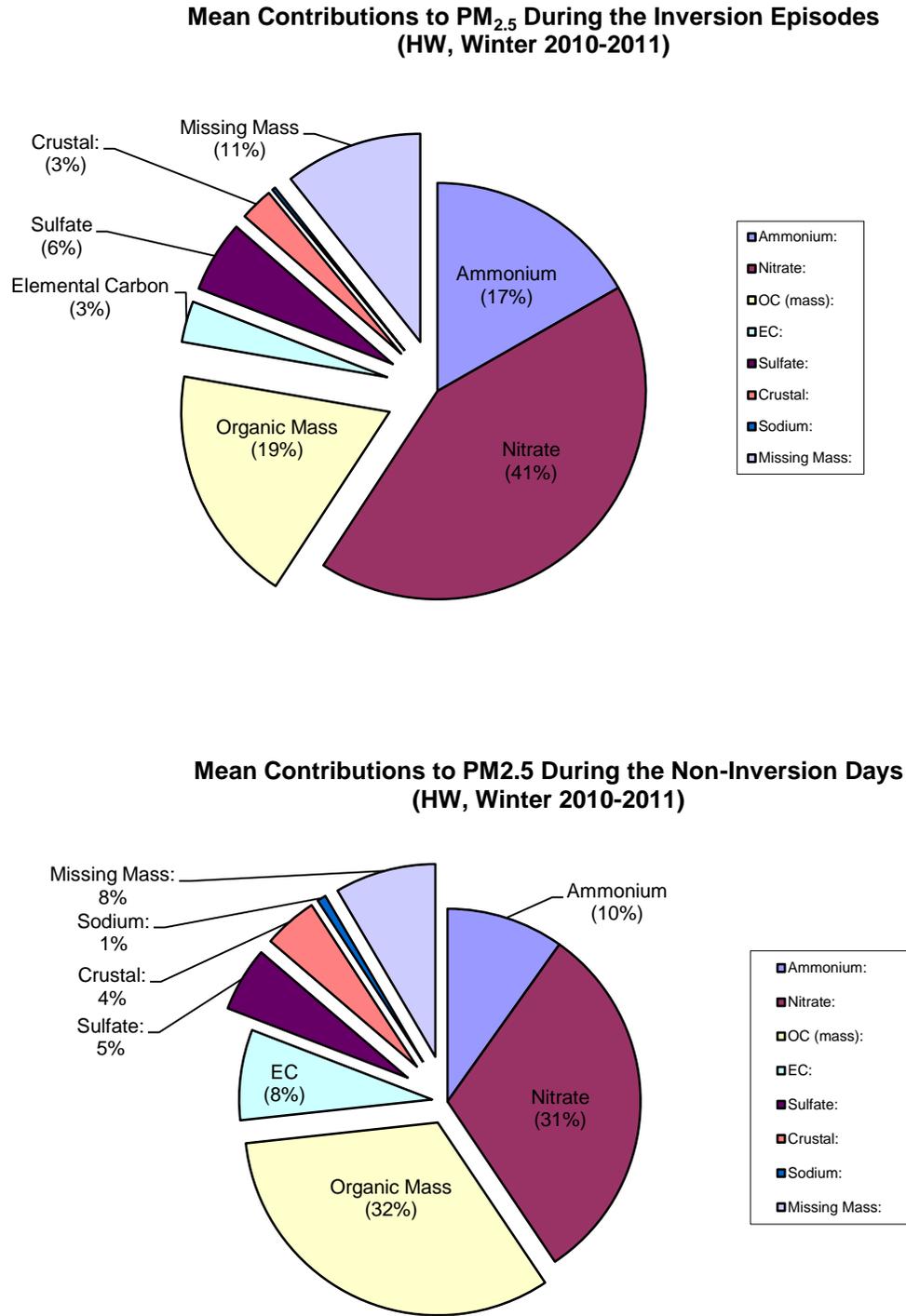


Figure 3.2, Composite Wintertime PM<sub>2.5</sub> Speciation Profiles

### 3.6 PCAP Study

The Persistent Cold Air Pooling Study (PCAPS) is National Science Foundation-funded project conducted by the University of Utah to investigate the processes leading to the formation, maintenance and destruction of persistent temperature inversions in Salt Lake Valley. The study ended in March of 2014. Field work for the project was conducted in the winter of 2010-2011 and focused on the meteorological dynamics of temperature inversions in the Salt Lake Valley and in the Bingham Canyon pit mine in the southwest corner of Salt Lake Valley. In addition to identifying key meteorological processes involved in the dynamics of temperature inversions in Salt Lake Valley, the other primary objectives of PCAPS is to determine how persistent temperature inversions affect air pollution transport and diffusion in urban basins and to develop more accurate meteorological models describing the formation, persistence and dispersion of temperature inversions in Salt Lake Valley.

Analyses of most data sets collected during the PCAPS are still underway. However, one study examining PM<sub>2.5</sub> concentrations along an elevation gradient north of Salt Lake City (1300-1750 meters) showed that PM<sub>2.5</sub> concentrations generally decreased with altitude and increased with time during a single temperature inversion event.<sup>1</sup> Final results from PCAPS will help DAQ understand both how persistent temperature inversions affect PM<sub>2.5</sub> concentrations along the Wasatch Front and will enhance DAQ's ability to accurately forecast the formation and breakup of temperature inversion that lead to poor wintertime air quality.

### 3.7 Ammonia (NH<sub>3</sub>) Studies

The Division of Air Quality deployed an ammonia monitor as a part of the special winter study for 2009. A URG 9000 instrument was used to record hourly values of ambient ammonia between the months of December and February.

The resulting measurements showed that the ambient concentration of ammonia tended to be generally an order of magnitude higher than those of nitric acid: 12-17 ppbv and 1-2 ppbv, respectively.

Unfortunately, the use of the instrument proved to be excessively labor intensive due to the high frequency of calibrations and corrections for drift. The data obtained during the winter of 2009, albeit valuable for rough estimation of the ambient ammonia concentrations, contained an abnormal amount of error for accurate mechanistic analysis.

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<sup>1</sup> Silcox, G.D., K.E. Kelly, E.T. Crosman, C.D. Whiteman, and B.L. Allen, 2012: Wintertime PM<sub>2.5</sub> concentrations in Utah's Salt Lake Valley during persistent multi-day cold air pools. *Atmospheric Environment*, 46, 17-24.

## Chapter 4 – EMISSION INVENTORY DATA

### 4.1 Introduction

The emissions inventory is one means used by the state to assess the level of pollutants and precursors released into the air from various sources. The methods by which emissions inventories are collected and calculated are constantly improving in response to better analysis and more comprehensive rules. The inventories underlying this SIP were compiled using the best information available.

The sources of emissions that were inventoried may be discussed as belonging to four general categories: industrial point sources; on-road mobile sources; off-road mobile sources; and area sources which represent a collection of smaller, more numerous point sources, residential activities such as home heating, and in some cases biogenic emissions.

This SIP is concerned with PM<sub>2.5</sub>, both primary in its origin and secondary, referring to its formation removed in time and space from the point of origin for certain precursor gasses. Hence, the pollutants of concern, at least for inventory development purposes, included PM<sub>2.5</sub>, SO<sub>2</sub>, NO<sub>x</sub>, VOC, and NH<sub>3</sub>.

On-road mobile sources are inventoried using EPA's MOVES2010 model, in conjunction with information generated by travel demand models such as vehicle speeds and miles traveled. The inventory information is calculated in units of tons per day, adjusted for winter conditions. Emissions from the other three categories are calculated in terms of tons per year.

Prior to use in the air quality model, the emissions are pre-processed to account for the seasonality of Utah's difficulty with secondary PM<sub>2.5</sub> formation during winter months. These temporal adjustments also account for daily and weekly activity patterns that affect the generation of these emissions.

To acknowledge the episodic and seasonal nature of Utah's elevated PM<sub>2.5</sub> concentrations, inventory information presented herein is, unless otherwise noted, a reflection of the temporal adjustments made prior to air quality modeling. This makes more appropriate the use of these inventories for such purposes as correlation with measured PM<sub>2.5</sub> concentrations, control strategy evaluation, establishing budgets for transportation conformity, and tracking rates of progress.

There are various time horizons that are significant to the development of this SIP. It is first necessary to look at past episodes of elevated PM<sub>2.5</sub> concentrations in order to develop the air quality model. The episodes studied as part of the SIP occurred in 2007, 2008, 2009, and 2010. It is then necessary to look several years into the future when developing emission control strategies. The significant time horizon for this plan relates to the statutory attainment date, December 31, 2015. A projected inventory for 2015 is prepared and compared with a baseline inventory that is contemporaneous with the monitored design values discussed in Section 3.4. This baseline is represented by the year 2010. Inventories must be prepared to evaluate all of these time horizons.

## **4.2 The 2008 Emissions Inventory**

The forgoing paragraph identified numerous points in time for which an understanding of emissions to the air is important to plan development. The basis for each of these assessments was the 2008 tri-annual inventory. This inventory represented, at the time it was selected for use, the most recent comprehensive inventory compiled by UDAQ. In addition to the large major point sources that are required to report emissions every year, the tri-annual inventories consider emissions from many more, smaller point sources. These inventories are collected in accordance with state and federal rules that ensure proper methods and comprehensive quality assurance.

Thus, to develop other inventories for each of the years discussed above, the 2008 inventory was either back-cast and adjusted for certain episodic conditions, or forecast to represent more typical conditions.

## **4.3 Characterization of Utah's Airsheds**

As said at the outset, an emissions inventory provides a means to assess the level of pollutants and precursors released into the air from various sources. This in turn allows for an overall assessment of a particular airshed or even a comparison of one airshed to another.

The modeling analysis used to support this SIP considers a regional domain that encompasses three distinct airsheds belonging to three distinct PM<sub>2.5</sub> nonattainment areas; The Cache Valley (the Logan UT/ID nonattainment area), the central Wasatch Front (Salt Lake City, UT nonattainment area), and the southern Wasatch Front (Provo, UT nonattainment area).

The inventories developed for each of these three areas illustrate many similarities but also a few notable differences. All three areas are more or less dominated by a combination of on-road mobile and area sources. However, emissions from large point sources are non-existent in the Cache Valley. These emissions are mostly situated along the Wasatch Front, and primarily exhibited in the Salt Lake City nonattainment area. Conversely, most of the agricultural emissions are located in the Cache Valley.

The tables presented below provide a broad overview of the emissions in the respective areas. They are organized to show the relative contributions of emissions by source category (e.g. point / area / mobile).

Table 4.1 shows the 2010 Baseline emissions in each area of the modeling domain.

NA-Area		Source Category	PM2.5	NOX	VOC	NH3	SO2
2010 Sum of Emissions (tpd)	<b>Logan, UT-ID</b>						
		Area Sources	0.54	1.63	4.16	4.31	0.26
		Mobile Sources	0.67	6.48	4.99	0.12	0.04
		NonRoad	0.13	1.15	2.28	0.00	0.02
		Point Sources	0.00	0.02	0.63	0.00	0.00
	<b>Total</b>		<b>1.35</b>	<b>9.28</b>	<b>12.06</b>	<b>4.43</b>	<b>0.32</b>
2010 Sum of Emissions (tpd)	<b>Provo, UT</b>						
		Area Sources	1.86	5.56	12.77	6.53	0.28
		Mobile Sources	2.20	25.39	15.63	0.44	0.16
		NonRoad	0.31	4.40	1.71	0.00	0.09
		Point Sources	0.26	0.93	0.67	0.29	0.03
	<b>Total</b>		<b>4.63</b>	<b>36.29</b>	<b>30.78</b>	<b>7.26</b>	<b>0.56</b>
2010 Sum of Emissions (tpd)	<b>Salt Lake City, UT</b>						
		Area Sources	5.87	17.71	51.53	17.96	0.88
		Mobile Sources	8.59	99.63	62.51	1.86	0.63
		NonRoad	1.27	23.04	9.50	0.01	0.66
		Point Sources	3.89	20.14	6.48	0.64	10.64
	<b>Total</b>		<b>19.62</b>	<b>160.51</b>	<b>130.02</b>	<b>20.47</b>	<b>12.81</b>
2010 Sum of Emissions (tpd)	<b>Surrounding Areas</b>						
		Area Sources	1.78	3.08	13.95	34.29	1.13
		Mobile Sources	2.31	28.89	11.03	0.33	0.15
		NonRoad	0.57	7.73	10.66	0.00	0.14
		Point Sources	3.39	129.34	2.92	0.75	43.43
	<b>Total</b>		<b>8.04</b>	<b>169.03</b>	<b>38.57</b>	<b>35.38</b>	<b>44.85</b>
<b>2010 Total</b>							

**Table 4.1, Emissions Summary for 2010 (SMOKE).** Emissions are presented in tons per average winter day. Mobile source emissions summaries are from the AP-42 (road dust) and MOVES model output. PM<sub>2.5</sub> for mobile sources includes tire and brake wear, sulfate, elemental and organic carbon, and road dust. VOC for mobile sources includes refueling spillage and displacement vapor loss emissions.

Table 4.2 is specific to the Salt Lake, UT nonattainment area, and shows emissions for both the baseline year and the attainment year. These totals include projections concerning growth in population, vehicle miles traveled, and the economy. They also include the effects of emissions control strategies that are either already promulgated or were required as part of the SIP.

	NA-Area	Source Category	PM2.5	NOX	VOC	NH3	SO2
<b>2010</b>	<b>Salt Lake City, UT</b>						
Sum of Emissions (tpd)		Area Sources	5.87	17.71	51.53	17.96	0.88
		Mobile Sources	8.59	99.63	62.51	1.86	0.63
		NonRoad	1.27	23.04	9.50	0.01	0.66
		Point Sources	3.89	20.14	6.48	0.64	10.64
		<b>Total</b>	<b>19.62</b>	<b>160.51</b>	<b>130.02</b>	<b>20.47</b>	<b>12.81</b>
<b>2015</b>	<b>Salt Lake City, UT</b>						
Sum of Emissions (tpd)		Area Sources	5.22	16.18	39.04	17.66	0.90
		Mobile Sources	8.20	77.59	47.33	1.59	0.72
		NonRoad	1.00	18.56	7.50	0.01	0.57
		Point Sources	4.26	22.81	8.59	1.29	7.87
		<b>Total</b>	<b>18.68</b>	<b>135.14</b>	<b>102.45</b>	<b>20.55</b>	<b>10.06</b>

**Table 4.2, Emissions Summaries for the Salt Lake City, UT Nonattainment Area; Baseline, RFP and Attainment Years (SMOKE).** Emissions are presented in tons per average winter day. Mobile source emissions summaries are from the AP-42 (road dust) and MOVES model output. PM<sub>2.5</sub> for mobile sources includes tire and brake wear, sulfate, elemental and organic carbon, and road dust. VOC for mobile sources includes refueling spillage and displacement vapor loss emissions.

The 2010 Baseline and 2015 projected emissions estimates are calculated from the Sparse Matrix Operator Kernel Model (SMOKE). More detailed inventory information may be found in the Technical Support Document (TSD).

## **Chapter 5 – ATTAINMENT DEMONSTRATION**

### **5.1 Introduction**

UDAQ conducted a technical analysis to support the development of Utah's 24-hr PM<sub>2.5</sub> State Implementation Plan (SIP). The analyses include preparation of emissions inventories and meteorological data, and the evaluation and application of regional photochemical model. An analysis using observational datasets will be shown to detail the chemical regimes of Utah's Nonattainment areas.

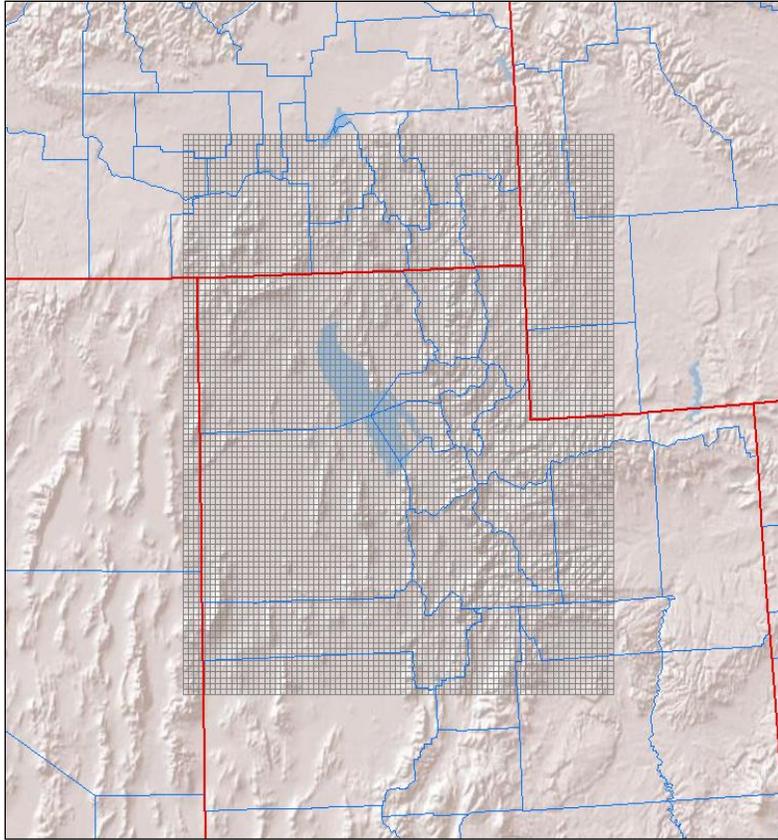
### **5.2 Photochemical Modeling**

Photochemical models are relied upon by federal and state regulatory agencies to support their planning efforts. Used properly, models can assist policy makers in deciding which control programs are most effective in improving air quality, and meeting specific goals and objectives.

The air quality analyses were conducted with the Community Multiscale Air Quality (CMAQ) Model version 4.7.1, with emissions and meteorology inputs generated using SMOKE and WRF, respectively. CMAQ was selected because it is the open source atmospheric chemistry model co-sponsored by EPA and the National Oceanic Atmospheric Administration (NOAA), thus approved by EPA for this plan.

### **5.3 Domain/Grid Resolution**

UDAQ selected a high resolution 4-km modeling domain to cover all of northern Utah including the portion of southern Idaho extending north of Franklin County and west to the Nevada border (Figure 5.1). This 97 x 79 horizontal grid cell domain was selected to ensure that all of the major emissions sources that have the potential to impact the nonattainment areas were included. The vertical resolution in the air quality model consists of 17 layers extending up to 15 km, with higher resolution in the boundary layer.



**Figure 5.1: Northern Utah photochemical modeling domain.**

#### **5.4 Episode Selection**

According to EPA's April 2007 "Guidance on the Use of Models and Other Analyses for Demonstrating Attainment of Air Quality Goals for Ozone, PM<sub>2.5</sub>, and Regional Haze" the selection of SIP episodes for modeling should consider the following 4 criteria:

1. Select episodes that represent a variety of meteorological conditions that lead to elevated PM<sub>2.5</sub>.
2. Select episodes during which observed concentrations are close to the baseline design value.
3. Select episodes that have extensive air quality data bases.
4. Select enough episodes such that the model attainment test is based on multiple days at each monitor violating NAAQS.

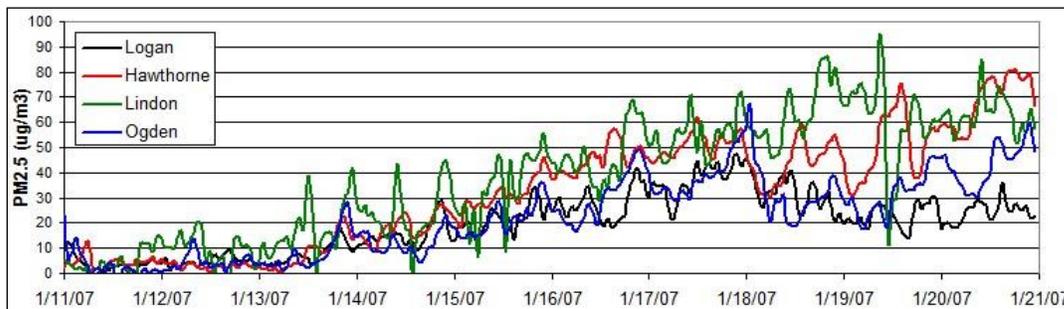
In general, UDAQ wanted to select episodes with hourly  $PM_{2.5}$  concentrations that are reflective of conditions that lead to 24-hour NAAQS exceedances. From a synoptic meteorology point of view, each selected episode features a similar pattern. The typical pattern includes a deep trough over the eastern United States with a building and eastward moving ridge over the western United States. The episodes typically begin as the ridge begins to build eastward, near surface winds weaken, and rapid stabilization due to warm advection and subsidence dominate. As the ridge centers over Utah and subsidence peaks, the atmosphere becomes extremely stable and a subsidence inversion descends towards the surface. During this time, weak insolation, light winds, and cold temperatures promote the development of a persistent cold air pool. Not until the ridge moves eastward or breaks down from north to south is there enough mixing in the atmosphere to completely erode the persistent cold air pool.

From the most recent 5-year period of 2007-2011, UDAQ developed a long list of candidate  $PM_{2.5}$  wintertime episodes. Three episodes were selected. An episode was selected from January 2007, an episode from February 2008, and an episode during the winter of 2009-2010 that features multi-event episodes of  $PM_{2.5}$  buildup and washout. Further detail of the episodes is below:

- **Episode 1: January 11-20, 2007**

A cold front passed through Utah during the early portion of the episode and brought very cold temperatures and several inches of fresh snow to the Wasatch Front. The trough was quickly followed by a ridge that built north into British Columbia and began expanding east into Utah. This ridge did not fully center itself over Utah, but the associated light winds, cold temperatures, fresh snow, and subsidence inversion produced very stagnant conditions along the Wasatch Front. High temperatures in Salt Lake City throughout the episode were in the high teens to mid-20's Fahrenheit.

Figure 5.2 shows hourly  $PM_{2.5}$  concentrations from Utah's 4  $PM_{2.5}$  monitors for January 11-20, 2007. The first 6 to 8 days of this episode are suited for modeling. The episode becomes less suited after January 18 because of the complexities in the meteorological conditions leading to temporary  $PM_{2.5}$  reductions.

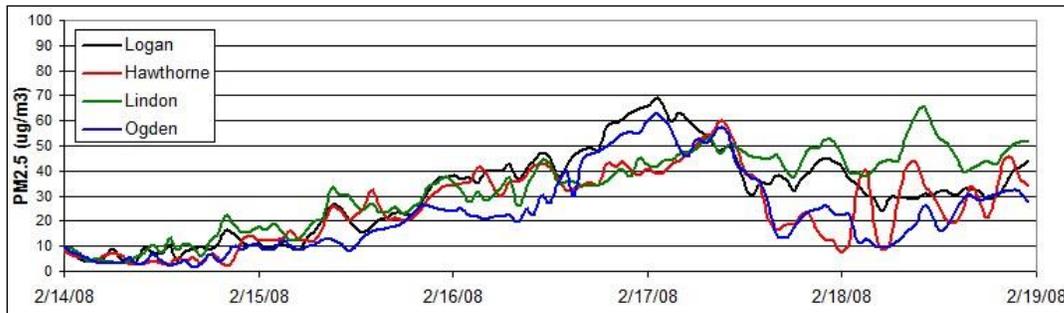


**Figure 5.2: Hourly  $PM_{2.5}$  concentrations for January 11-20, 2007**

- **Episode 2: February 14-18, 2008**

The February 2008 episode features a cold front passage at the start of the episode that brought significant new snow to the Wasatch Front. A ridge began building eastward from the Pacific Coast and centered itself over Utah on Feb 20<sup>th</sup>. During this time a subsidence inversion lowered significantly from February 16 to February 19. Temperatures during this episode were mild with high temperatures at SLC in the upper 30's and lower 40's Fahrenheit.

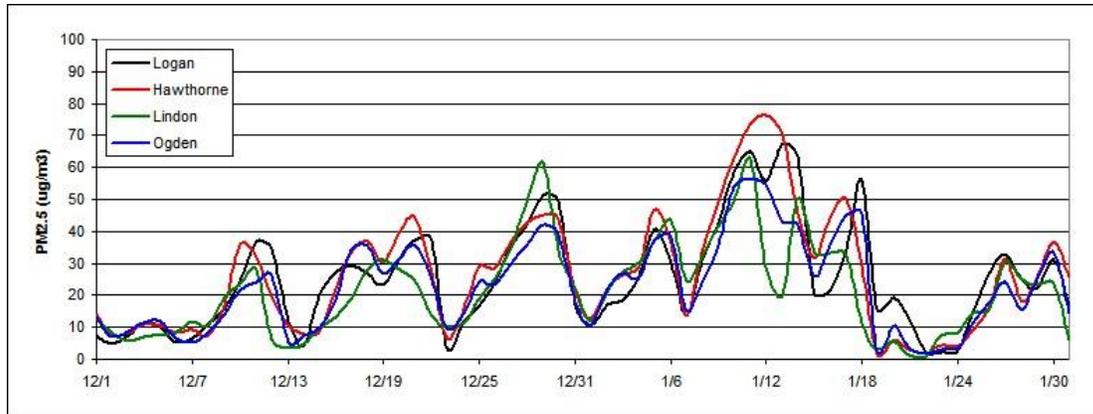
The 24-hour average PM<sub>2.5</sub> exceedances observed during the proposed modeling period of February 14-19, 2008 were not exceptionally high. What makes this episode a good candidate for modeling are the high hourly values and smooth concentration build-up. The first 24-hour exceedances occurred on February 16 and were followed by a rapid increase in PM<sub>2.5</sub> through the first half of February 17 (Figure 5.3). During the second half of February 17, a subtle meteorological feature produced a mid-morning partial mix-out of particulate matter and forced 24-hour averages to fall. After February 18, the atmosphere began to stabilize again and resulted in even higher PM<sub>2.5</sub> concentrations during February 20, 21, and 22. Modeling the 14<sup>th</sup> through the 19<sup>th</sup> of this episode should successfully capture these dynamics. The smooth gradual build-up of hourly PM<sub>2.5</sub> is ideal for modeling.



**Figure 5.3: Hourly PM<sub>2.5</sub> concentrations for February 14-19, 2008**

- **Episode 3: December 13, 2009 – January 18, 2010**

The third episode that was selected is more similar to a “season” than a single PM<sub>2.5</sub> episode (Figure 5.4). During the winter of 2009 and 2010, Utah was dominated by a semi-permanent ridge of high pressure that prevented strong storms from crossing Utah. This 35 day period was characterized by 4 to 5 individual PM<sub>2.5</sub> episodes each followed by a partial PM<sub>2.5</sub> mix out when a weak weather system passed through the ridge. The long length of the episode and repetitive PM<sub>2.5</sub> build-up and mix-out cycles makes it ideal for evaluating model strengths and weaknesses and PM<sub>2.5</sub> control strategies.



**Figure 5.4: 24-hour average PM<sub>2.5</sub> concentrations for December-January, 2009-10.**

## 5.5 Meteorological Data

Meteorological inputs were derived using the Weather Research and Forecasting (WRF), Advanced Research WRF (WRF-ARW) model version 3.2. WRF contains separate modules to compute different physical processes such as surface energy budgets and soil interactions, turbulence, cloud microphysics, and atmospheric radiation. Within WRF, the user has many options for selecting the different schemes for each type of physical process. There is also a WRF Preprocessing System (WPS) that generates the initial and boundary conditions used by WRF, based on topographic datasets, land use information, and larger-scale atmospheric and oceanic models.

Model performance of WRF was assessed against observations at sites maintained by the Utah Air Monitoring Center. A summary of the performance evaluation results for WRF are presented below:

- The biggest issue with meteorological performance is the existence of a warm bias in surface temperatures during high PM<sub>2.5</sub> episodes. This warm bias is a common trait of WRF modeling during Utah wintertime inversions.
- WRF does a good job of replicating the light wind speeds (< 5 mph) that occur during high PM<sub>2.5</sub> episodes.
- WRF is able to simulate the diurnal wind flows common during high PM<sub>2.5</sub> episodes. WRF captures the overnight downslope and daytime upslope wind flow that occurs in Utah valley basins.
- WRF has reasonable ability to replicate the vertical temperature structure of the boundary layer (i.e., the temperature inversion), although it is difficult for WRF to reproduce the inversion when the inversion is shallow and strong (i.e., an 8 degree temperature increase over 100 vertical meters).

## 5.6 Photochemical Model Performance Evaluation

The model performance evaluation focused on the magnitude, spatial pattern, and temporal variation of modeled and measured concentrations. This exercise was intended to assess whether, and to what degree, confidence in the model is warranted (and to assess whether model improvements are necessary).

CMAQ model performance was assessed with observed air quality datasets at UDAQ-maintained air monitoring sites (Figure 5.5). Measurements of observed  $PM_{2.5}$  concentrations along with gaseous precursors of secondary particulate (e.g.,  $NO_x$ , ozone) and carbon monoxide are made throughout winter at most of the locations in Figure 5.5.  $PM_{2.5}$  speciation performance was assessed using the three Speciation Monitoring Network Sites (STN) located at the Hawthorne site in Salt Lake City, the Bountiful site in Davis County, and the Lindon site in Utah County.

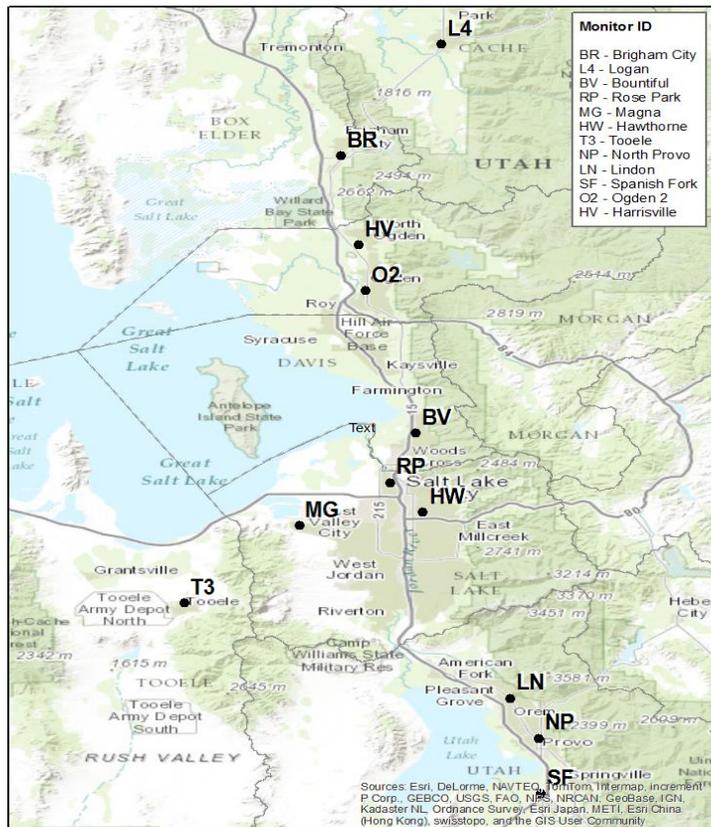


Figure 5.5: UDAQ monitoring network.

A spatial plot is provided for modeled 24-hr  $PM_{2.5}$  for 2010 January 03 in Figure 5.6. The spatial plot shows the model does a reasonable job reproducing the high  $PM_{2.5}$  values, and keeping those high values confined in the valley locations where emissions occur.

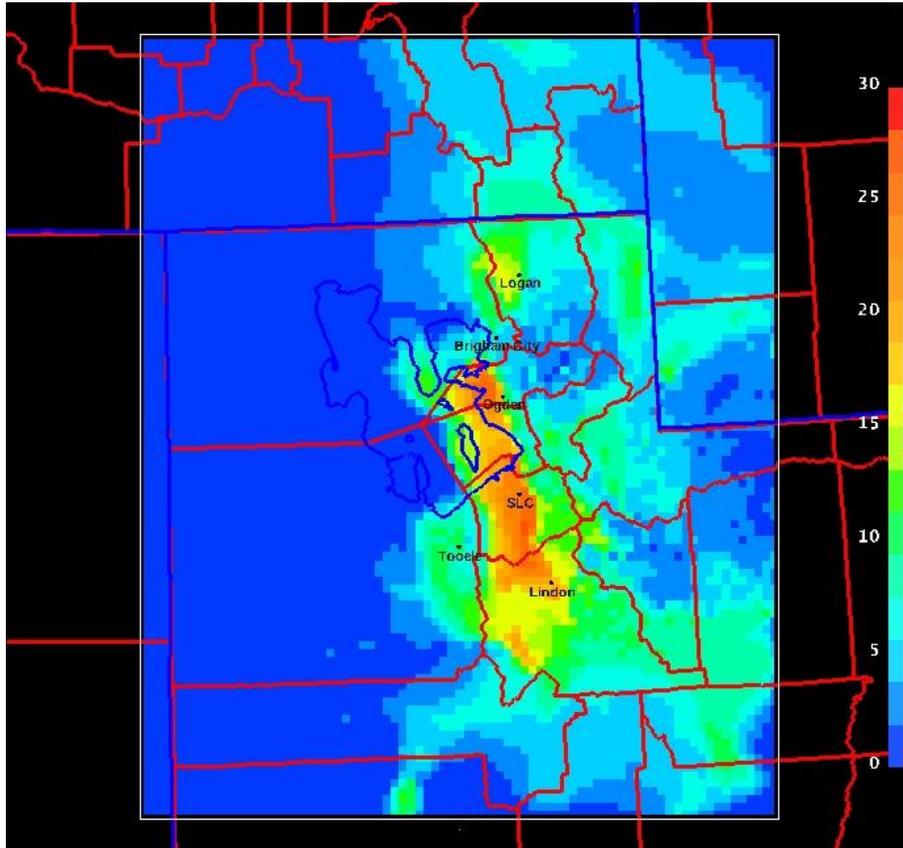


Figure 5.6: Spatial plot of CMAQ modeled 24-hr  $PM_{2.5}$  ( $\mu\text{g}/\text{m}^3$ ) for 2010 Jan. 03.

Time series of 24-hr  $PM_{2.5}$  concentrations for the 13 Dec. 2009 – 15 Jan. 2010 modeling period are shown in Figs. 5.7 – 5.10 at the Hawthorne site in Salt Lake City (Fig. 5.7), the Ogden site in Weber County (Fig. 5.8), the Lindon site in Utah County (Fig. 5.9), and the Logan site in Cache County (Fig. 5.10). For the most part, CMAQ replicates the buildup and washout of each individual episode. While CMAQ builds 24-hr  $PM_{2.5}$  concentrations during the 08 Jan. – 14 Jan. 2010 episode, it was not able to produce the  $> 60 \mu\text{g}/\text{m}^3$  concentrations observed at the monitoring locations.

It is often seen that CMAQ “washes” out the  $PM_{2.5}$  episode a day or two earlier than that seen in the observations. For example, on the day 21 Dec. 2009, the concentration of  $PM_{2.5}$  continues to build while CMAQ has already cleaned the valley basins of high  $PM_{2.5}$  concentrations. At these times, the observed cold pool that holds the  $PM_{2.5}$  is often very shallow and winds just above this cold pool are southerly and

strong before the approaching cold front. This situation is very difficult for a meteorological and photochemical model to reproduce. An example of this situation is shown in Fig. 5.11, where the lowest part of the Salt Lake Valley is still under a very shallow stable cold pool, yet higher elevations of the valley have already been cleared of the high PM<sub>2.5</sub> concentrations.

During the 24 – 30 Dec. 2009 episode, a weak meteorological disturbance brushes through the northernmost portion of Utah. It is noticeable in the observations at the Ogden monitor at 25 Dec. as PM<sub>2.5</sub> concentrations drop on this day before resuming an increase through Dec. 30. The meteorological model and thus CMAQ correctly pick up this disturbance, but completely clears out the building PM<sub>2.5</sub>; and thus performance suffers at the most northern Utah monitors (e.g. Ogden, Logan). The monitors to the south (Hawthorne, Lindon) are not influence by this disturbance and building of PM<sub>2.5</sub> is replicated by CMAQ. This highlights another challenge of modeling PM<sub>2.5</sub> episodes in Utah. Often during cold pool events, weak disturbances will pass through Utah that will de-stabilize the valley inversion and cause a partial clear out of PM<sub>2.5</sub>. However, the PM<sub>2.5</sub> is not completely cleared out, and after the disturbance exits, the valley inversion strengthens and the PM<sub>2.5</sub> concentrations continue to build. Typically, CMAQ completely mixes out the valley inversion during these weak disturbances.

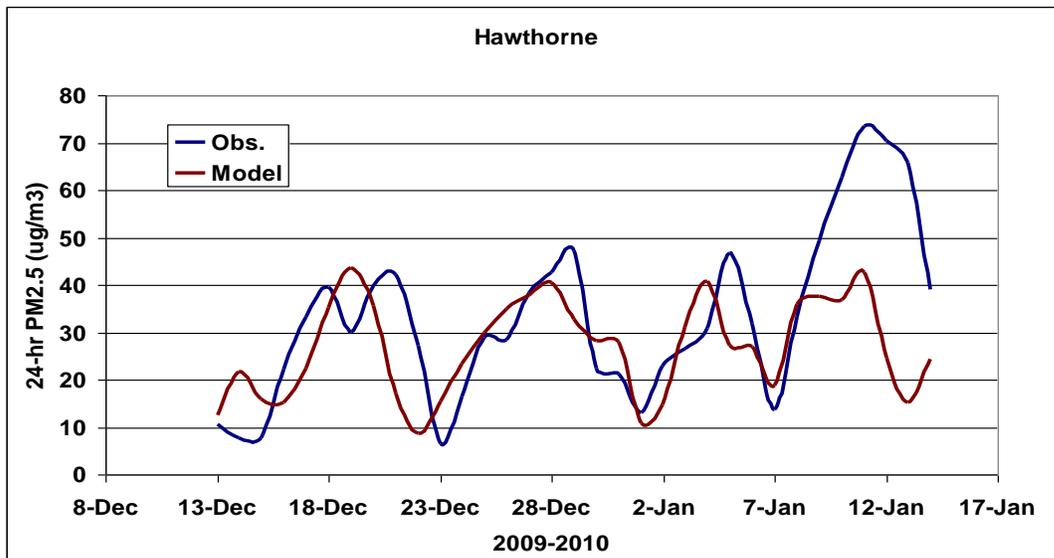


Figure 5.7: 24-hr PM<sub>2.5</sub> time series (Hawthorne). Observed 24-hr PM<sub>2.5</sub> (blue trace) and CMAQ modeled 24-hr PM<sub>2.5</sub> (red trace).

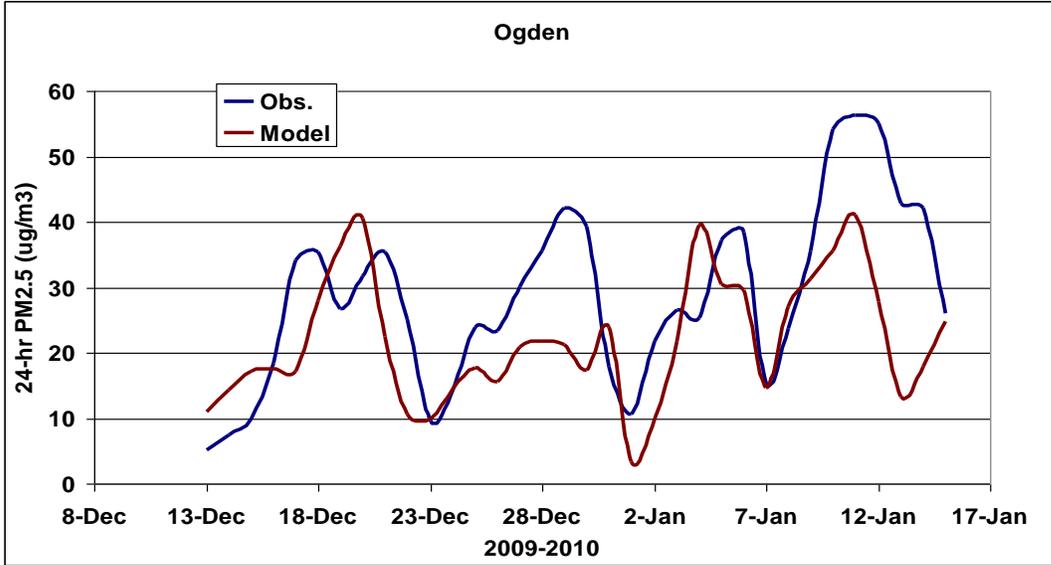


Figure 5.8: 24-hr PM<sub>2.5</sub> time series (Ogden). Observed 24-hr PM<sub>2.5</sub> (blue trace) and CMAQ modeled 24-hr PM<sub>2.5</sub> (red trace).

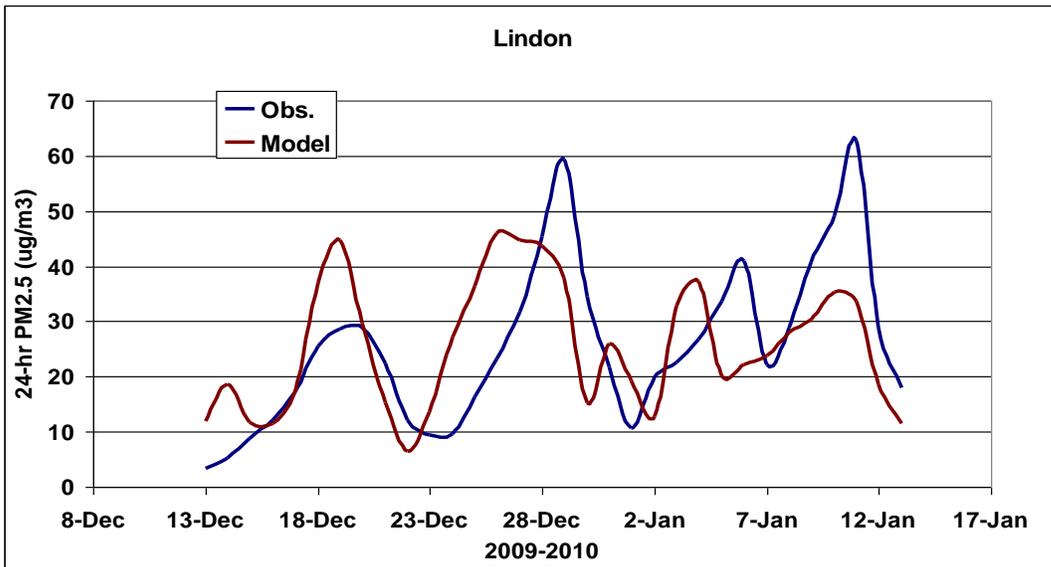


Figure 5.9: 24-hr PM<sub>2.5</sub> time series (Lindon). Observed 24-hr PM<sub>2.5</sub> (blue trace) and CMAQ modeled 24-hr PM<sub>2.5</sub> (red trace).

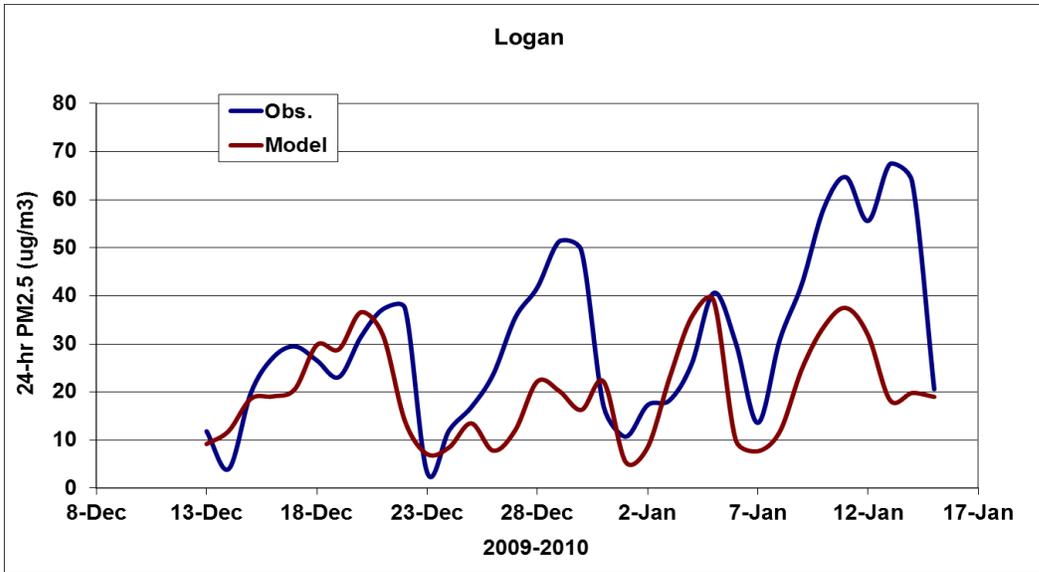


Figure 5.10: 24-hr PM<sub>2.5</sub> time series (Logan). Observed 24-hr PM<sub>2.5</sub> (blue trace) and CMAQ modeled 24-hr PM<sub>2.5</sub> (red trace).



Figure 5.11: An example of the Salt Lake Valley at the end of a high PM<sub>2.5</sub> episode. The lowest elevations of the Salt Lake Valley are still experiencing an inversion and elevated PM<sub>2.5</sub> concentrations while the PM<sub>2.5</sub> has been 'cleared out' throughout the rest of the valley. These 'end of episode' clear out periods are difficult to replicate in the photochemical model.

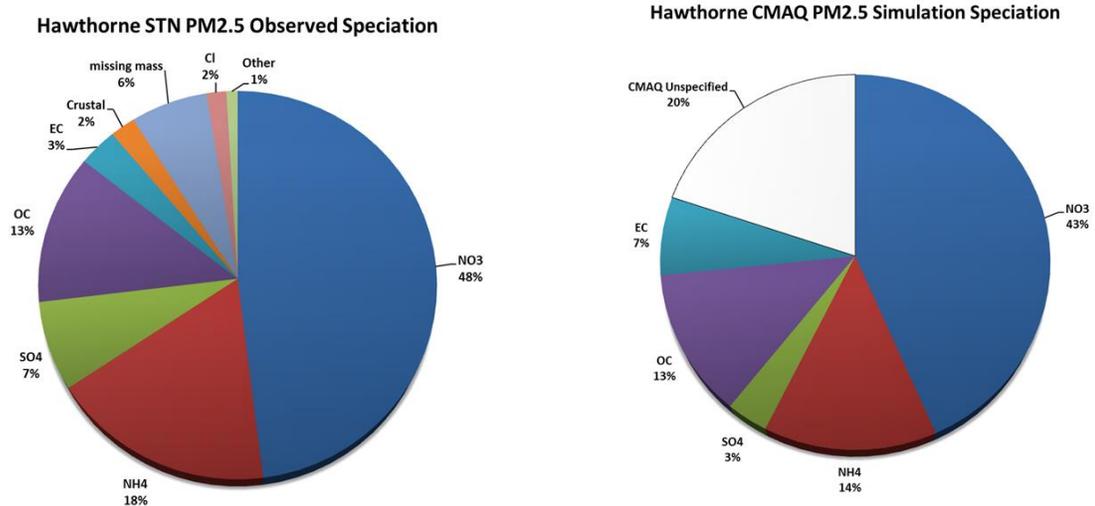
Generally, the performance of CMAQ to replicate the buildup and clear out of PM<sub>2.5</sub> is good. However, it is important to verify that CMAQ is replicating the components of PM<sub>2.5</sub> concentrations. PM<sub>2.5</sub> simulated and observed speciation is shown at the 3 STN sites in Figures 5.12 – 5.14. The observed speciation is constructed using days in which the STN filter 24-hr PM<sub>2.5</sub> concentration was > 35 µg/m<sup>3</sup>. For the 2009-2010 modeling period, the observed speciation pie charts were created using 8 filter days at Hawthorne, 6 days at Lindon, and 4 days at Bountiful. The speciation of this small dataset appears similar to a comparison of a larger dataset of STN filter speciated data from 2005-2010 for high wintertime PM<sub>2.5</sub> days (see Figure 3.2 for one of these at Hawthorne).

The simulated speciation is constructed using modeling days that produced 24-hr PM<sub>2.5</sub> concentrations > 35 µg/m<sup>3</sup>. Using this criterion, the simulated speciation pie chart is created from 18 modeling days for Hawthorne, 14 days at Lindon, and 14 days at Bountiful.

At all 3 STN sites, the percentage of simulated nitrate is greater than 40%, while the simulated ammonium percentage is at ~15%. This indicates that the model is able to replicate the secondarily formed particulates that typically make up the majority of the measured PM<sub>2.5</sub> on the STN filters during wintertime pollution events.

The percentage of model simulated organic carbon is ~13% at all STN sites, which is in agreement with the observed speciation of organic carbon at Hawthorne and slightly overestimated (by ~3%) at Lindon and Bountiful.

There is no STN site in the Logan nonattainment area, and very little speciation information available in the Cache Valley. Figure 5.15 shows the model simulated speciation at Logan. Ammonium (17%) and nitrate (56%) make up a higher percentage of the simulated PM<sub>2.5</sub> at Logan when compared to sites along the Wasatch Front.



**Figure 5.12:** The composition of observed and model simulated average 24-hr PM<sub>2.5</sub> speciation averaged over days when an observed and modeled day had 24-hr concentrations > 35 µg/m<sup>3</sup> at the Hawthorne STN site.

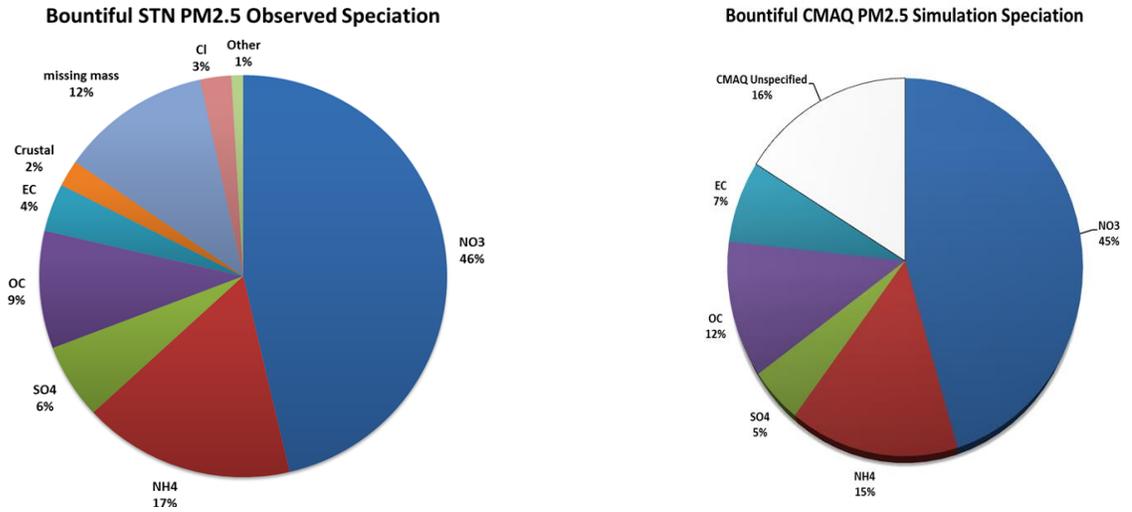


Figure 5.13: The composition of observed and model simulated average 24-hr PM<sub>2.5</sub> speciation averaged over days when an observed and modeled day had 24-hr concentrations > 35 µg/m<sup>3</sup> at the Bountiful STN site.

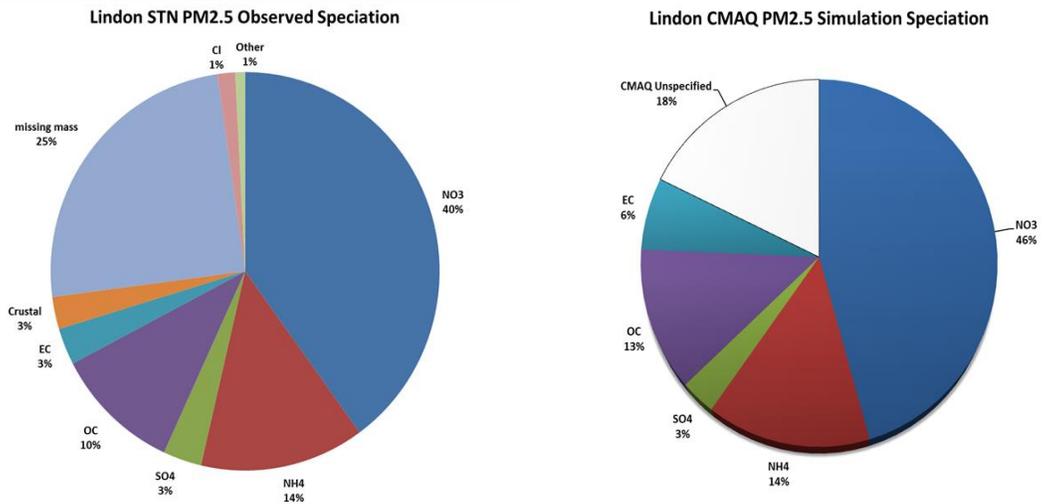
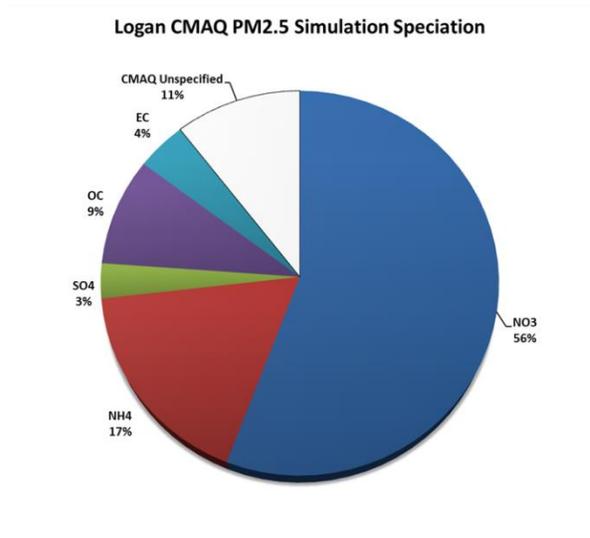


Figure 5.14: The composition of observed and model simulated average 24-hr PM<sub>2.5</sub> speciation averaged over days when an observed and modeled day had 24-hr concentrations > 35 µg/m<sup>3</sup> at the Lindon STN site.



**Figure 5.15:** The composition of model simulated average 24-hr PM<sub>2.5</sub> speciation averaged over days when a modeled day had 24-hr concentrations > 35 µg/m<sup>3</sup> at the Logan monitoring site. No observed speciation data is available for Logan.

## 5.7 Summary of Model Performance

Model performance for 24-hr PM<sub>2.5</sub> is good and generally acceptable and can be characterized as follows:

- Good replication of the episodic buildup and clear out of PM<sub>2.5</sub>. Often the model will clear out the simulated PM<sub>2.5</sub> a day too early at the end of an episode. This clear out time period is difficult to model (i.e., Figure 5.11).
- Good agreement in the magnitude of PM<sub>2.5</sub>, as the model can consistently produce the high concentrations of PM<sub>2.5</sub> that coincide with observed high concentrations.
- Spatial patterns of modeled 24-hr PM<sub>2.5</sub>, show for the most part, that the PM<sub>2.5</sub> is being confined in the valley basins, consistent to what is observed.
- Speciation and composition of the modeled PM<sub>2.5</sub> matches the observed speciation quite well. Modeled and observed nitrate are between 40% and 50% of the PM<sub>2.5</sub>. Ammonium is between 15% and 20% for both modeled and observed PM<sub>2.5</sub>, while modeled and observed organic carbon falls between 10% to 13% of the total PM<sub>2.5</sub>.

Several observations should be noted on the implications of these model performance findings on the attainment modeling presented in the following section. First, it has been demonstrated that model performance overall is acceptable and, thus, the model can be used for air quality planning purposes. Second, consistent with EPA guidance, the model is used in a relative sense to project future year values. EPA suggests that this approach “should reduce some of the uncertainty attendant with using absolute model predictions alone.” Furthermore, the attainment modeling is supplemented by additional information to provide a weight of evidence determination.

### 5.8 Modeled Attainment Test

UDAQ employed Model Attainment Test Software (MATS) for the modeled attainment test at grid cells near monitors. MATS is designed to interpolate the species fractions of the PM mass from the Speciation Trends Network (STN) monitors to the FRM monitors. The model also calculates the relative response factor (RRF) for grid cells near each monitor and uses these to calculate a future year design value for these cells.

MATS results for future year modeling is presented in Figure 5.16. The future year design values are presented with and without SIP controls for 2015 (the attainment year). For comparison purposes, the monitored design value is also presented for the base year, 2010.

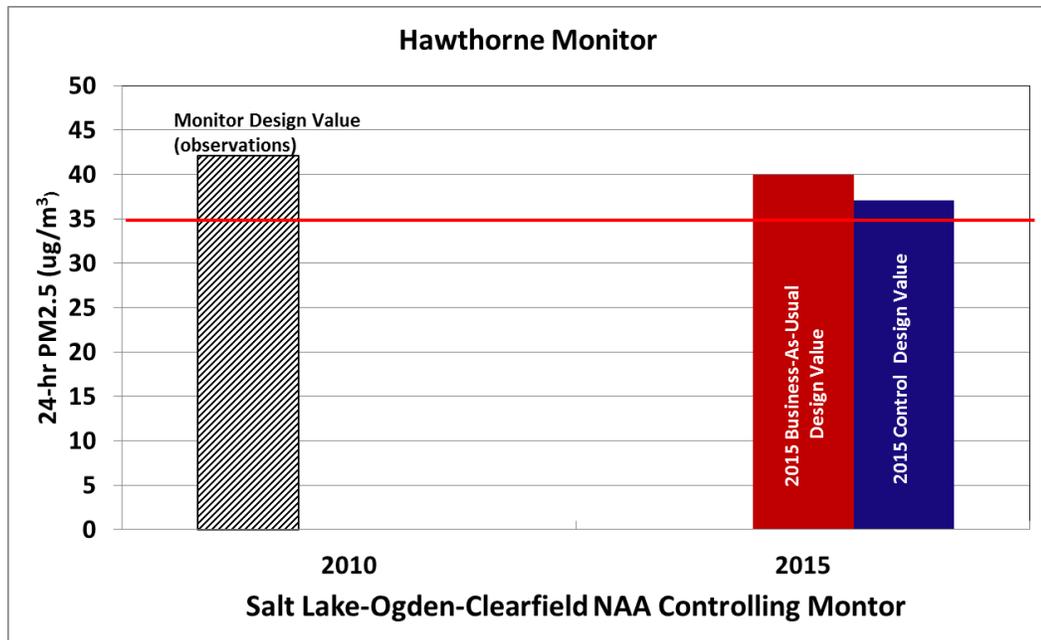


Figure 5.16, Model Results for the Salt Lake City, UT Nonattainment Area

Table 5.1 presents the same information in tabular form, and also includes any additional monitoring locations in the nonattainment area.

	2010	2015	
	Observed	Business-As-Usual	Control Basket
<b>Bountiful</b>	37	34	32
<b>Brigham City</b>	40	34	31
<b>Harrisville</b>	35	33	30
<b>Hawthorne</b>	42	40	37
<b>Magna</b>	32	30	27
<b>Ogden 2</b>	38	35	33
<b>Rose Park</b>	39	38	34
<b>Tooele</b>	25	22	19

**Table 5.1, Modeled Concentrations ( $\mu\text{g}/\text{m}^3$ ) for the Salt Lake City, UT Nonattainment Area**

The "Control Basket" inventory that is presented in Table 5.1 consists of a combination of SIP reductions on point sources and new rules to be implemented that will affect smaller commercial and industrial businesses. All of these changes are detailed in Chapter 6 - Control Measures. Summary tables of the emission inventories that result from the Control Basket reductions are available in the TSD: Section 3 Baseline and Control Strategies.

### 5.9 Air Quality as of the Attainment Date

The attainment date for this moderate  $\text{PM}_{2.5}$  nonattainment area is December 31, 2015. The plan provisions for moderate areas call, in Section 189(a)(1)(B), for either a demonstration that the plan will provide for attainment by the applicable attainment date or a demonstration that attainment by such date is impracticable.

As shown in the modeled attainment test, the emissions reductions achievable in 2015 do not allow for a demonstration that the Salt Lake City, UT nonattainment area can attain the 24-hour  $\text{PM}_{2.5}$  NAAQS. Although predictions at seven of the eight monitors are less than  $35 \mu\text{g}/\text{m}^3$ , the predicted concentration at the Hawthorne monitor is still above the standard.

As discussed in Section 6.6, the emissions modeled in the "control basket" scenario reflect (at least) all RACM and RACT measures achievable in practice by the statutory implementation date (December 14, 2014). Therefore, what has been demonstrated is that attainment of the 24-hour standard by December 31, 2015 is impracticable.

## **Chapter 6 – CONTROL MEASURES**

### **6.1 Introduction**

Attaining the 2006, 24-hour NAAQS for PM<sub>2.5</sub> will require emission controls from directly emitted PM<sub>2.5</sub> as well as PM<sub>2.5</sub> precursors (SO<sub>2</sub>, NO<sub>x</sub> and VOC). It will involve emission sources from each of the four sectors identified in the discussion on emission inventories (stationary point sources, area sources, on-road mobile sources and off-road mobile sources). Furthermore, it will entail control measures of two basic types: existing measures; and measures imposed through this SIP.

This chapter summarizes the overall control strategy for the plan. Additional detail concerning individual emission control measures, including the emissions reductions to be expected, is contained in the Technical Support Document.

### **6.2 Utah Stakeholder Workgroup Efforts**

In response to increasing interest in Utah's air quality problems and the need for greater participation in reducing air emissions, the Utah Division of Air Quality (DAQ) created a significant and meaningful role for public participation in the PM<sub>2.5</sub> SIP development process. The public involvement process was driven by a need for transparency and inclusivity of public health and business interests impacted by air quality issues.

DAQ's measures of success for the public involvement process were:

- Buy-in from public, stakeholders, and elected officials,
- SIP recommendations that are championed and implemented, and ;
- Close working relationship with partner organizations to deliver a unified message.

Measures of success for participants were:

- Having a say in plans that impacted their communities,
- Access to information and time to understand issues and provide input,
- Access to DAQ staff and the SIP development process,
- Meaningful participation in the process, and;
- Transparency of the process.

Public participation centered on creating workgroups with members from each county within the PM<sub>2.5</sub> nonattainment area—Box Elder, Cache, Davis, Salt Lake, Tooele, Utah, and Weber. More than 100 people from agriculture, academia, environmental groups, state and local elected officials, industry, and the public volunteered to participate. Their participation ensured that the SIP development process would have grassroots-level input about strategies and their impacts on a countywide level.

Workgroup members were engaged in four rounds of meetings created to provide and gather information. After providing a baseline level of knowledge during Meeting One, draft emissions reductions were discussed during Meetings Two and Three, each followed by a survey to capture new ideas and feedback. Responses from the survey, and other feedback received during the process, were used to refine emissions inventories, in some cases significantly, refine mitigation strategies, provide new strategies, and provide ideas for implementation. Meeting Four was an opportunity for workgroup members to introduce the SIP package to the public and talk about the development process before one of several public comment hearings held in the nonattainment counties.

The public participation process was not without challenges. One of the most difficult was providing information that could get a diverse group of stakeholders to understand very complex and technical air quality and emissions reductions issues. Despite the challenges, the process was successful and contributed to a well-rounded and well-vetted SIP package.

### **6.3 Identification of Measures**

In considering the suite of control measures that could be implemented as part of this plan several important principles were applied to expedite the analysis.

Filter data shows that secondary particulate is the portion of mass most responsible for exceedances of the standard on episode days, and specifically shows that ammonium nitrate is the single largest component of that material. In addition, it shows that organic carbon represents the bulk of primary PM<sub>2.5</sub>.

Priority was given to those source categories or pollutants responsible for relatively larger percentages of the emissions leading to exceedances of the PM<sub>2.5</sub> NAAQS. The emissions inventory compiled to represent base-year conditions was useful in identifying the contributors to these emissions, particularly in their relation to the formation of ammonium nitrate.

At the same time, the air quality modeling shed light on the sensitivity of the airshed in its response to changes in different pollutants. VOC was immediately identified as a significant contributor to elevated PM<sub>2.5</sub> concentrations, and proved to be more limiting in the overall atmospheric chemistry than NO<sub>x</sub>. This pointed the search for viable control strategies toward VOC emissions, and somewhat away from NO<sub>x</sub>. It also became apparent that directly emitted PM<sub>2.5</sub>, while a relatively small portion of the overall filter mass, is independent of the non-linear chemical transformation to particulate matter. Therefore,

any reduction in PM<sub>2.5</sub> emissions will directly improve future PM<sub>2.5</sub> concentrations, and like VOC, made these emissions an attractive target for potential control measures. Subsequent modeling revealed that, as time progressed and the relative concentrations of NO<sub>x</sub> and VOC changed, controlling for NO<sub>x</sub> would yield more benefit in terms of controlling PM<sub>2.5</sub>. Ammonia is also prominent in chemical reactions that produce secondary PM<sub>2.5</sub>, but it occurs in such abundance that PM<sub>2.5</sub> concentrations are sensitive only to unachievable reductions in ammonia.

#### **6.4 Existing Control Measures**

Since about 1970 there have been regulations at both state and federal levels to mitigate air contaminants. It follows that the estimates of emissions used in modeled attainment demonstration for this Plan take into account the effectiveness of existing control measures. These measures affect not only the levels of current emissions, but some continue to affect emissions trends as well.

An example of the former would be the effectiveness of an add-on control device at a stationary point source. It is presently effective in controlling emissions, and will continue to be that effective five years from now.

An example of the latter would be a federal rule that affects the manufacture of engines. The engines already sold into the airshed are effective in reducing emissions, but the number of these engines replacing older, higher emitting engines is increasing. Therefore, a rule such as this also affects the trend of emissions for that source category in a positive way.

The effectiveness of any control measure that was in place, and enforceable, at the time this Plan was written has been accounted for in the tabulation of baseline emissions and projected emissions.

The following paragraphs discuss some of the more important control strategies that are already in place for the four basic sectors of the emissions inventory.

##### Stationary Point Sources:

Utah's permitting rules require a review of new and modified major stationary sources in nonattainment areas, as is required by Section 173 of the Clean Air Act. Beyond that however, even minor sources and minor modifications to major sources planning to locate anywhere in the state are required to undergo a new source review analysis and receive an approval order to construct. Part of this review is an analysis to ensure the application of Best Available Control Technology (BACT). This requirement is ongoing and ensures that Utah's industry is well controlled.

Along the central Wasatch Front, stationary sources were required to reduce emissions at several junctures to address nonattainment issues with SO<sub>2</sub>, ozone and PM<sub>10</sub>.

SIPs for ozone and SO<sub>2</sub> in 1981 each resulted in control of precursors to secondary particulate. There were SO<sub>2</sub> reductions at the copper smelter and VOC reductions at the refineries. In addition, Control Techniques Guideline documents (CTGs) affecting VOC emissions at a variety of industrial source categories were incorporated into Utah's air quality rules.

In the early 1990s, stationary sources were required to reduce PM<sub>10</sub>, SO<sub>2</sub>, and NO<sub>x</sub> to address wintertime PM<sub>10</sub> nonattainment.

Any of the source-specific emission controls or operating practices that has been required as a result of the forgoing has been reflected in the baseline emissions calculated for the large stationary sources, and therefore evaluated in the modeled demonstration.

#### Area sources:

Stage 1 vapor control was introduced in Salt Lake and Davis Counties as part of the 1981 ozone SIP. This is a method of collecting VOC vapors, as underground gasoline storage tanks are filled at gas stations, and returning those vapors to a facility where they are collected and recycled. Since that time it has been extended to include the entire state.

Part of the PM<sub>10</sub> control for Salt Lake and Davis Counties in the early 1990s was a program to curtail woodsmoke emissions during periods of atmospheric stagnation. Woodsmoke is rich in VOC emissions in addition to the particulate matter which is almost entirely within the PM<sub>2.5</sub> size fraction. In 2006 the woodburning program was extended to include the western half of Weber County as well.

CTGs adopted into Utah's air quality rules to control VOC emissions in Salt Lake and Davis Counties, as part of the 1981 ozone SIP, are also effective in controlling emissions from area sources.

#### Energy Efficiency

EPA recognizes the benefits of including energy efficiency programs in SIP's as a low cost means of reducing emissions. Two established energy efficiency programs that result in direct emission reductions within the Wasatch Front are already in place.

#### *Questar Gas ThermWise Rebate Programs*

Questar started the ThermWise Rebate Programs on January 1, 2007 as a way to promote the use of energy-efficient appliances and practices among its customers. The ThermWise Programs offer rebates to help offset the initial cost of energy-efficient appliances and weatherization. There are also rebates available for energy efficient new construction. The cost of rebates is built into the Questar gas rate. The rebates are vetted by the Utah Public Service Commission's strict "cost-effectiveness" tests. To pass these tests, Questar must prove that the energy cost savings produced by the ThermWise Programs exceeds the cost of the rebates. There is no scheduled end to the ThermWise Programs. According to the Questar program information, the program will remain in place as long as rebates remain cost-effective.

UDAQ calculates area source emissions for natural gas by multiplying emission factors against actual and projected yearly gas usage data submitted by Questar. In this way, actual realized program reductions are expressed in the past year (baseline) emission inventory. Future investment in energy efficiency is not captured in our projected future gas usage. Continuance of this program will result in future gas emissions that are lower than projected.

#### *Weatherization Assistance Program*

The Weatherization Assistance Program helps low-income individuals and families reduce energy costs. Individuals, families, the elderly and the disabled who are making no more than 200 percent of the current federal poverty income level are eligible for help. However, priority is given to the elderly and disabled, households with high-energy consumption, emergency situations and homes with preschool-age children.

The Utah Division of Housing and Community Development administer the program statewide through eight government and nonprofit agencies. Benefits are provided in the form of noncash grants to eligible households to make energy-efficiency improvements to those homes.

The energy efficiency realized from this program is also imbedded within the gas usage data UDAQ receives from Questar.

On-road mobile sources:

The federal motor vehicle control program has been one of the most significant control strategies affecting emissions that lead to PM<sub>2.5</sub>. Since 1968, the program has required newer vehicles to meet ever more stringent emission standards for CO, NO<sub>x</sub>, and VOC. Tier 1 standards were established in the early 1990s and were fully implemented by 1997. The Tier 1 emission standards can be found in Table 6.1. The EPA created a voluntary clean car program on January 7, 1998 (63 FR January 7, 1998), which was called the National Low Emission Vehicle (NLEV) program. This program asked auto manufacturers to commit to meet tailpipe standards for light duty vehicles that were more stringent than Tier 1 standards.

EPA Tier 1 Emission Standards for Passenger Cars and Light-Duty Trucks, FTP 75, g/mi						
Category	100,000 miles/10 years <sup>1</sup>					
	THC	NMHC	CO	NO <sub>x</sub> <sup>2</sup> diesel	NO <sub>x</sub> gasoline	PM <sup>3</sup>
Passenger cars	-	0.31	4.2	1.25	0.6	0.1
LLDT, LVW <3,750 lbs	0.8	0.31	4.2	1.25	0.6	0.1
LLDT, LVW >3,750 lbs	0.8	0.4	5.5	0.97	0.97	0.1
HLDT, ALVW <5,750 lbs	0.8	0.46	6.4	0.98	0.98	0.1
HLDT, ALVW > 5,750 lbs	0.8	0.56	7.3	1.53	1.53	0.12

1 - Useful life 120,000 miles/11 years for all HLDT standards and for THC standards for LDT

2 - More relaxed NO<sub>x</sub> limits for diesels applicable to vehicles through 2003 model year

3 - PM standards applicable to diesel vehicles only

**Abbreviations:**

LVW - loaded vehicle weight (curb weight + 300 lbs)

ALVW - adjusted LVW (the numerical average of the curb weight and the GVWR)

LLDT - light light-duty truck (below 6,000 lbs GVWR)

HLDT - heavy light-duty truck (above 6,000 lbs GVWR)

**Table 6.1, Tier 1 Emission Standards**

Shortly thereafter, EPA promulgated the Tier 2 program. This program went into effect on April 10, 2000 (65 FR 6698 February 10, 2000) and was phased in between 2004 and 2008. Tier 2 introduced more stringent numerical emission limits compared to the previous program (Tier 1). Tier 2 set a single set of standards for all light duty vehicles. The Tier 2 emission standards are structured into 8 permanent and 3 temporary certification levels of different stringency, called “certification bins,” and an average fleet standard for NO<sub>x</sub> emissions. Vehicle manufacturers have a choice to certify particular vehicles to any of the available bins. The program also required refiners to reduce gasoline sulfur levels nationwide, which was fully implemented in 2007. The sulfur levels need to be reduced so that Tier 2 vehicles could run correctly and maintain their effectiveness. The EPA estimated that the Tier 2 program will reduce oxides of nitrogen emissions by at least 2,220,000 tons per year nationwide in 2020<sup>1</sup>. Tier 2 has also contributed in reducing VOC and direct PM emissions from light duty vehicles. Tier 2 standards are summarized in Table 6.2 below.

Tier 2 Emission Standards, FTP 75, g/mi					
Bin#	Full Useful Life				
	NMOG*	CO	NO <sub>x</sub> †	PM	HCHO
Temporary Bins					
11 MDPV <sup>c</sup>	0.28	7.3	0.9	0.12	0.032
10 <sup>a,b,d</sup>	0.156 (0.230)	4.2 (6.4)	0.6	0.08	0.018 (0.027)
9 <sup>a,b,e</sup>	0.090 (0.180)	4.2	0.3	0.06	0.018
Permanent Bins					
8 <sup>b</sup>	0.125 (0.156)	4.2	0.2	0.02	0.018
7	0.09	4.2	0.15	0.02	0.018
6	0.09	4.2	0.1	0.01	0.018
5	0.09	4.2	0.07	0.01	0.018
4	0.07	2.1	0.04	0.01	0.011
3	0.055	2.1	0.03	0.01	0.011
2	0.01	2.1	0.02	0.01	0.004
1	0	0	0	0	0
* for diesel fueled vehicle, NMOG (non-methane organic gases) means NMHC (non-methane hydrocarbons)					
† average manufacturer fleet NO <sub>x</sub> standard is 0.07 g/mi for Tier 2 vehicles					

<sup>1</sup> 65 FR 6698 February 10, 2000

- a - Bin deleted at end of 2006 model year (2008 for HLDTs)
- b - The higher temporary NMOG, CO and HCHO values apply only to HLDTs and MDPVs and expire after 2008
- c - An additional temporary bin restricted to MDPVs, expires after model year 2008
- d - Optional temporary NMOG standard of 0.280 g/mi (full useful life) applies for qualifying LDT4s and MDPVs only
- e - Optional temporary NMOG standard of 0.130 g/mi (full useful life) applies for qualifying LDT2s only

**Abbreviations:**

LDT2 – light duty trucks 2 (0-6,000 lbs. GVWR, 3,751-5,750 lbs. LVW)

LDT4 – light duty trucks 4 (6,001-8,500 lbs. GVWR, 5,751 lbs. and greater ALVW)

MDPV – medium duty passenger vehicle

HLDT - heavy light duty truck (above 6,000 lbs GVWR)

**Table 6.2, Tier 2 Emission Standards**

In addition to the benefits from Tier 2 in the current emissions inventories, the emission projections for 2015 in this SIP continue to reflect significant improvements in both VOC and NO<sub>x</sub> as older vehicles are replaced with Tier 2 vehicles. This trend may be seen in the inventory projections for on-road mobile sources despite the growth in vehicles and vehicle miles traveled that are factored into the same projections.

Additional on-road mobile source emissions improvement stemmed from federal regulations for heavy-duty diesel vehicles. The Highway Diesel Rule, which aimed at reducing pollution from heavy-duty diesel highway vehicles, was finalized in January 2001. Under the rule, beginning in 2007 (with a phase-in through 2010) heavy-duty diesel highway vehicle emissions were required to be reduced by as much 90 percent with a goal of complete fleet replacement by 2030. In order to enable the updated emission-reduction technologies necessitated by the rule, beginning in 2006 (with a phase-in through 2009) refiners were required to begin producing cleaner-burning ultra-low sulfur diesel fuel. Specifically, the rule required a 97 percent reduction in sulfur content from 500 parts per million (ppm) to 15 ppm. The overall nationwide effect of the rule is estimated to be equivalent to removing the pollution from over 90 percent of trucks and buses when the fleet turnover is completed in 2030.

To supplement the federal motor vehicle control program, Inspection / Maintenance (I/M) Programs were implemented in Salt Lake and Davis Counties in 1984. A program for Weber County was added in 1990. These programs have been effective in identifying vehicles that no longer meet the emission specifications for their respective makes and models, and in ensuring that those vehicles are repaired in a timely manner.

Off-road mobile sources:

Several significant regulatory programs enacted at the federal level will affect emissions from non-road mobile emission sources. This category of emitters includes airplanes, locomotives, hand-held engines, and larger portable engines such as generators and construction equipment. The effectiveness of these controls has been incorporated into the "NONROAD" model UDAQ uses to compile the inventory information for this source category. Thus, the controls have already been factored into the projection inventories used in the modeled attainment demonstration.

EPA rules for non-road equipment and vehicles are grouped into various "tiers" in a manner similar to the tiers established for on-road motor vehicles. To date, non-road rules have been promulgated for Tiers 0 through IV, where the oldest equipment group is designated "Tier 0" and the newest equipment, some of which has yet to be manufactured, falls into "Tier IV."

Of note are the following:

Locomotives

Locomotive engine regulation began with Tier 0 standards promulgated in 1998, which apply to model year 2001 engines.

In addition, because of the very long lifetimes of these engines, often up to forty years, Tier 0 standards include remanufacturing standards, which apply to locomotive engines of model years 1973 through 2001.

Subsequent tier standards for line-haul locomotives apply as follows:

Tier	Applicable Model Years
Tier I	2002 - 2004
Tier II	2005 - 2011
Tier III	2012 - 2014
Tier IV	2015 - newer

Yard or "switch" locomotives are regulated under different standards than line-haul locomotives.

Lastly, EPA has promulgated remanufacturing standards for Tier I and 2 locomotive engines to date.

Large Engines

Large non-road engines are usually diesel-powered but include some gasoline-powered equipment.

Large land-based diesel equipment (> 37 kw or 50 hp) used in agricultural, construction and industrial applications are regulated under Tier I rules, which apply to model years 1996 through 2000. Subsequent Tier II through IV rules apply to newer model-year equipment.

Some large non-road engines are gasoline-powered (spark-ignition). These include equipment such as forklifts, some airport ground support equipment, recreational equipment such as ATVs, motorcycles and snowmobiles. These are regulated under various tiers in a manner similar to diesel equipment.

### Small Engines

Small engines are generally gasoline-powered (spark-ignition). Equipment includes handheld and larger non-handheld types. Handheld equipment includes lawn and garden power tools such as shrub trimmers, saws and dust blowers. Non-handheld equipment includes equipment such as lawnmowers and lawn tractors. From an emissions standpoint, smaller engine size is offset by the large number of pieces of equipment in use by households and commercial establishments. This equipment is regulated under a tiered structure as well.

### Emissions Benefit

Each major revision of the non-road tier standards results in a large reduction of carbon monoxide, hydrocarbons, nitrogen oxides and particulate matter.

For example, the Non-road Diesel Tier II and III Rule, which regulates model-year 2001 through 2008 diesel equipment (> 37 kw or 50 hp) is estimated by EPA, in its Regulatory Announcement for this rule dated August 1998, to decrease NO<sub>x</sub> emissions by a million tons per year by 2010, the equivalent of taking 35 million passenger cars off the road.

EPA further estimates, in its Regulatory Announcement dated May 2004, that the Tier IV non-road diesel rule is expected to decrease exhaust emissions per piece of equipment by over 90 percent compared to older equipment.

### Low-Sulfur Diesel

Non-road diesel equipment is required to operate on diesel fuel with a sulfur content of no greater than 500 ppm beginning June 1, 2007.

Beginning June 1, 2010, non-road diesel equipment must operate on "ultra-low" sulfur diesel with a sulfur content of no more than 15 ppm.

Locomotives and certain marine engines must operate on ultra-low sulfur diesel by June 1, 2012.

## 6.5 SIP Controls

Beyond the benefits attributable to the controls already in place, there are new controls identified by this SIP that provide additional benefit toward reaching attainment. A summary of the plan strategy is presented here for each of the emission source sectors.

Overall, within the Salt Lake City – UT nonattainment area, the strategy to reduce emissions results in 27.4 tons per day of combined PM<sub>2.5</sub>, SO<sub>2</sub>, NO<sub>x</sub> and VOC in 2015.

## 6.6 Reasonably Available Control Measures (RACM/RACT)

Section 172 of the CAA requires that each attainment plan “provide for the implementation of all reasonably available control measures (RACM) as expeditiously as practicable (including such reductions in emissions from existing sources in the area as may be obtained through the adoption, at a minimum, of reasonably available control technology (RACT)), and shall provide for attainment of the NAAQS.”

Now that the Courts have determined that Subpart 4 applies to PM<sub>2.5</sub> nonattainment areas, it is also instructive to consider paragraph 189(a)(1)(C), which requires that “provisions to assure that reasonably available control measures ... shall be implemented no later than ... 4 years after designation in the case of an area classified as moderate after the date of the enactment of the Clean Air Act Amendments of 1990.” All three of Utah’s nonattainment areas for PM<sub>2.5</sub> were designated so on December 14, 2009. Hence, December 14, 2013 was the date by which all RACM was to have been implemented.

EPA interprets RACM as referring to measures of any type that may be applicable to a wide range of sources (mobile, area, or stationary), whereas RACT refers to measures applicable to stationary sources. Thus, RACT is a type of RACM specifically designed for stationary sources. For both RACT and RACM, potential control measures must be shown to be both technologically and economically feasible.

Pollutants to be addressed by States in establishing RACT and RACM limits in their PM<sub>2.5</sub> attainment plans will include primary PM<sub>2.5</sub> as well as precursors to PM<sub>2.5</sub>. For the control strategy in this plan, those pollutants include SO<sub>2</sub>, NO<sub>x</sub> and VOC.

In general, the combined approach to RACT and RACM includes the following steps: 1) identification of potential measures that are reasonable, 2) modeling to test the control strategy, and 3) selection of RACT and RACM.

This basic process was applied to each of the four basic sectors of the emissions inventory:

### Stationary Point sources:

*Reasonably Available Control Technology* – As stated above, RACT refers to measures applicable to stationary sources. Thus, RACT is a type of RACM specifically designed for stationary sources.

Section 172 does not include any specific applicability thresholds to identify the size of sources that States and EPA must consider in the RACT and RACM analysis. In developing the emissions inventories underlying the SIP, the criteria of 40 CFR 51 for air emissions reporting requirements was used to establish a 100 ton per year threshold for identifying a sub-group of stationary point sources that would be evaluated individually. The cut-off was applied to either a sources reported emissions for 2008 or for its potential to emit in a given year. The rest of the point sources were assumed to represent a portion of the overall area source inventory.

Sources meeting the criteria described above were individually evaluated to determine whether their operations would be consistent with RACT.

SIPs for PM<sub>2.5</sub> must assure that the RACT requirement is met, either through a new RACT determination or a certification that previously required RACT controls (e.g. for another pollutant such as PM<sub>10</sub>) represent RACT for PM<sub>2.5</sub>.

In conducting the analysis, UDAQ found that, as a whole, the large stationary sources were already operating with a high degree of emission control. It follows that the percentage of SIP related emissions reductions is not large relative to the overall quantity of emissions. As stated before, many of these sources were required to reduce emissions to address nonattainment issues with SO<sub>2</sub>, ozone and PM<sub>10</sub>. Routine permitting in these areas of nonattainment already includes BACT as an ongoing standard of review, even for minor sources and modifications. In order to find additional emission reductions at these sources, UDAQ identified a level of emission control that goes beyond reasonable, or RACT, and achieves the best available control.

Additional information regarding the RACT analysis for each of the sources in the nonattainment area may be found in the Technical Support Document.

For the Salt Lake City, UT nonattainment area, there are 28 stationary point sources that met or meet the criteria of 100 tons per year for PM<sub>2.5</sub> or any precursor. The emissions from these sources that were modeled for the 2010 baseline as well as the 2015 attainment year are shown below in Table 6.3.<sup>1</sup> Note that these emissions also include the growth projections that were applied. Information is provided in the TSD regarding the emissions reductions specific to reduction strategies resulting from the SIP.

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<sup>1</sup> As noted above, the RACT implementation date given in CAA section 189(a)(1)(c), in Subpart 4, was December 14, 2013. As an editorial note, UDAQ had initially prepared this SIP under guidance pointing only to Subpart 1 of the CAA. That reading of the Act had resulted in a SIP with a different construct. It had identified an attainment date that was as expeditious as practicable, yet that date would have required all of the additional 5 years availed under section 172(a)(2)(A). Implementation of RACM and RACT, under that construct, was also to be as expeditious as practicable but in no case later than one year prior to the attainment date identified in the plan. Thus, RACT measures could have been implemented as late as December 14, 2018. Additionally, the requirement to address reasonable further progress (RFP) had identified two earlier milestones (2014 and 2017), and these presented additional targets for RACT implementation. Thus, the overall plan had incorporated a phased-in implementation schedule for measures identified as RACT.

When Subpart 4 superseded the more general planning requirements of Subpart 1, it was no longer permissible to request an extension of the attainment date. Instead, it became incumbent on the planning agency to determine either that the plan will provide for attainment by the applicable attainment date, or that attainment by such date is impracticable.

The attainment date for this moderate nonattainment area is December 31, 2015 and the RACT implementation date (having passed) was December 14, 2013. Many of the control strategies initially identified, under only Subpart 1, as RACT cannot be implemented by that prescribed date. This raises the question as to whether such measures would even be considered reasonable, either technologically or economically.

Nevertheless, UDAQ has retained this portion of the control strategy in the Emission Limits section of this State Implementation Plan. UDAQ is also demonstrating in this plan that attainment of the 2006, 24-hour NAAQS for PM<sub>2.5</sub> is impracticable by the attainment date. As part of that showing, the emissions reductions associated with all of the technologies and measures identified as RACT under only Subpart 1 were reflected in the emissions inventory modeled for the year 2015. This overstates the degree of control in 2015, however, from the standpoint of demonstrating that it is impracticable to attain the standard in 2015, provides a measure of conservatism to the overall conclusion.

Typical Winter Inversion Weekday			2010_(R2)					2015_(R9)				
Emissions (tpd)			Baseline					Growth & Control				
Source Category	NA-Area	Site	PM2.5	NOX	VOC	NH3	SO2	PM2.5	NOX	VOC	NH3	SO2
<b>Point Sources</b>	<b>Salt Lake City, UT</b>											
		ATK Thiokol Promontory	0.135	0.360	0.141	0.002	0.042	0.144	0.354	0.150	0.003	0.045
		Bountiful City Power	0.174	0.697	1.284	0.311	1.065	0.087	0.624	1.264	0.311	0.392
		Central Valley Water	0.000	0.005	0.001		0.000	0.082	0.209	0.049		0.002
		CER Generation II LLC - WVC	0.004	0.034	0.137	0.000	0.003	0.004	0.043	0.033	0.000	0.003
		Chemical Lime Company	0.015	0.039	0.005		0.002	0.015	0.039	0.005		0.002
		Chevron Refinery	0.036	0.043	0.001	0.000	0.034	0.008	0.058	0.002	0.000	0.044
		Flying J Refinery	0.501	2.991	0.663	0.026	1.774	0.105	1.950	1.234	0.022	1.092
		Geneva Rock Point of Mountain	0.069	0.269	0.050		0.037	0.084	0.323	0.060		0.026
		Great Salt Lake Minerals - Production Plant	0.132	0.249	0.023	0.002	0.018	0.107	0.304	0.061	0.003	0.026
		Hexcel Corporation Salt Lake Operations	0.048	0.217	0.180	0.079	0.024	0.103	0.102	0.111	0.129	0.009
		Hill Air Force Base Main	0.037	0.525	0.826	0.006	0.008	0.035	0.373	0.800	0.006	0.008
		Holly Refining Marketing	0.147	0.851	0.663	0.057	1.318	0.134	0.933	0.700	0.654	0.309
		Interstate Brick Brick	0.175	0.114	0.010		0.036					
		Kennecott Mine Concentrator	0.647	8.492	0.504	0.003	0.008	0.854	12.130	0.651	0.004	0.014
		Kennecott NC-UPP-Lab-Tailings	0.014	0.016	0.005	0.001	0.000	0.300	0.197	0.069	0.001	0.034
		Kennecott Smelter & Refinery	0.610	0.470	0.027	0.016	3.023	0.837	0.767	0.068	0.025	3.827
		Murray City Power	0.000	0.001	0.000		0.000					
		Nucor Steel	0.158	0.502	0.202	0.006	0.118	0.351	0.978	0.353	0.004	0.833
		Olympia Sales Co.	0.014	0.001	0.072	0.000	0.000	0.000	0.001	0.091	0.000	0.000
		Pacificorp Gadsby	0.067	0.443	0.031	0.065	0.006	0.067	0.437	0.031	0.065	0.006
		Pacificorp Little Mountain	0.021	1.014	0.007		0.011					
		Proctor & Gamble Paper Products Co.	0.099	0.043	0.067		0.003	0.575	0.674	0.654		0.007
		Silver Eagle Refining	0.011	0.246	0.359	0.012	0.003					
		Tesoro Refinery	0.710	1.162	0.806	0.011	2.808	0.272	1.297	1.005	0.010	0.819
		University of Utah	0.024	0.313	0.023	0.009	0.003	0.030	0.159	0.022	0.008	0.003
		Utility Trailer	0.002	0.117	0.215		0.001					
		Vulcraft	0.017	0.020	0.147	0.000	0.001	0.044	0.030	1.134	0.000	0.002
		Wasatch Integrated IE	0.019	0.903	0.033	0.039	0.292	0.024	0.832	0.042	0.049	0.371
		<b>Salt Lake City, UT Total</b>	<b>3.885</b>	<b>20.138</b>	<b>6.482</b>	<b>0.645</b>	<b>10.638</b>	<b>4.261</b>	<b>22.811</b>	<b>8.590</b>	<b>1.294</b>	<b>7.874</b>

**Table 6.3, Point Source Emissions; Baseline and Projections with Growth and Control**

*New Source Review / Banked Emission Reduction Credits* – Under Utah’s new source review rules in R307-403-8, banking of emission reduction credits (ERCs) is permitted to the fullest extent allowed by applicable Federal Law as identified in 40 CFR 51, Appendix S, among other documents. Under Appendix S, Section IV.C.5, a permitting authority may allow banked ERCs to be used under the preconstruction review program (R307-403) as long as the banked ERCs are identified and accounted for in the SIP control strategy. In the past, Utah has accounted for existing banked ERCs in SIP control strategies, ensuring that a pool of ERCs was available for new or modified sources in nonattainment areas. For the PM<sub>2.5</sub> SIP, however, it was not possible to include banked ERCs in the attainment demonstration. The PM<sub>2.5</sub> SIP adopted by the Air Quality Board on December 4, 2013 did not include banked PM<sub>2.5</sub> or PM<sub>2.5</sub> precursor ERCs in the attainment demonstration<sup>1</sup> and therefore under R307-403-8 any ERCs that were banked prior to December 4, 2013 may not be used as PM<sub>2.5</sub> major source or major modification emission offsets for PM<sub>2.5</sub> nonattainment areas. The use of these existing banked ERCs to meet the requirements of existing SIPs for PM<sub>10</sub>, SO<sub>2</sub> and ozone are not affected by the PM<sub>2.5</sub> SIP and would be evaluated according to the provisions of those SIPs. Any ERCs generated after December 4, 2013 for PM<sub>2.5</sub> or PM<sub>2.5</sub> precursors would have been accounted for in the PM<sub>2.5</sub> attainment demonstration and are eligible to be used as emission offsets for PM<sub>2.5</sub> or PM<sub>2.5</sub> precursors. DAQ has established a new registry for PM<sub>2.5</sub> ERCs generated after December 4, 2013 to ensure that qualifying ERCs are tracked.

Area sources:

The area source RACM analysis consisted of a thorough review of the entire area source inventory for anthropocentrically derived direct PM<sub>2.5</sub> and precursors constituents. There was no emission threshold level established in the review process; instead, the analysis centered on whether reasonable control measures are available for a given source category. The following table identifies these categories as well as the pollutant(s) likely to be controlled, and provides some remarks as to whether a control strategy was ultimately pursued. In considering what source categories might be considered, Utah made use of EPA recommendations included in Control Techniques Guideline Documents (CTG’s), as well as control strategies from other states. DAQ evaluated each strategy for technical feasibility as part of the RACM analysis. The screening column in the table identifies whether or not a strategy was retained for rulemaking or screened out for impracticability.

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<sup>1</sup> The SIP revision adopted by the Utah Air Quality Board on December 4, 2013 had demonstrated attainment by December 14, 2019. This SIP revision includes a demonstration under CAA Section 189(a)(1)(B) that it is impracticable to attain the NAAQS in 2015. Banked emission credits were not included in this demonstration either.

**Table 6.4 Area Source Strategy Screening**

Strategy	Constituent(s)	Screening Status	Remarks
1. Repeal current surface coating rule, R307-340. Replace this rule with individual rules for each category. New rules include PM <sub>2.5</sub> nonattainment areas. New rules update applicability and control limits to most current CTG. Current rule includes, paper, fabric and vinyl, metal furniture, large appliance, magnet wire, flat wood, miscellaneous metal parts and graphic arts.	VOC	Retained	R307-340 previously applied to Davis and Salt Lake counties. R307-340 was withdrawn and re-enacted as separate rules for each existing category. The new rules were expanded to nonattainment areas and updated to the most current RACT based limit(s).
2. New separate surface coating rules for following sources: a. Aerospace b. High performance c. Architectural d. Marine e. Sheet, strip & coil f. Traffic markings g. Plastic parts	VOC	See Remarks Column	Aerospace – retained  High performance – not retained, regulated under Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)  Architectural – initially not retained, further research indicated that adopting the Ozone Transport Commission model rule is feasible.  Marine – not retained, only 1.2 tpy  Sheet, strip & coil – retained  Traffic markings – not retained, regulated under FIFRA  Plastic parts - retained
3. Agricultural practices using Natural Resources Conservation Service (NRSC) practice standards	VOC, PM <sub>2.5</sub> , ammonia	Not Retained	The NRCS has already enrolled most farmers in the erodible regions in their program thereby negating the need for rulemaking
4. Consumer products rule regulating VOC content	VOC	Retained	
5. Adhesives and sealant rule	VOC	Retained	
6. Expand current solvent degreasing rule R307-335 to PM <sub>2.5</sub> nonattainment areas and add a new section on industrial solvent cleaning	VOC	Retained	
7. Automobile refinishing rule	VOC	Retained	
8. Expand wood furniture manufacturing rule to PM <sub>2.5</sub> nonattainment areas. Update to most current CTG.	VOC	Retained	
9. Lower the no burn cut point for residential use of solid fuel burning devices. Require new sale of EPA certified stoves/fireplaces. Prohibit the sale/resale of noncertified stoves in nonattainment areas.	VOC, PM <sub>2.5</sub> , NO <sub>x</sub> , SO <sub>x</sub> , ammonia	Retained	
10. Ban new sales of stick type outdoor wood boilers in nonattainment areas.	VOC, PM <sub>2.5</sub> , NO <sub>x</sub> , SO <sub>x</sub> , ammonia	Retained	
11. Industrial bakery rule	VOC	Initially Retained	Screened out after analysis of public comment, cost benefit analysis does not support rulemaking, high cost-low VOC reduction
12. Restaurant charbroiler emission control: - Chain-driven - Underfire	VOC, PM <sub>2.5</sub>	Chain-driven Retained  Underfire-Not Retained	No reasonable control measures available at this time for underfire charbroiling
13. Appliance pilot light phase out	VOC, PM <sub>2.5</sub> ,	Retained	

Strategy	Constituent(s)	Screening Status	Remarks
	NO <sub>x</sub> , SO <sub>x</sub> , ammonia		
14. Expand current fugitive dust rule, R307-309 to PM <sub>2.5</sub> nonattainment areas. Require BMP's for dust plans.	PM <sub>2.5</sub>	Retained	
15. Amend fugitive dust rule to include cattle feed lot	PM <sub>2.5</sub>	Not Retained	Sizeable feed lots are not located in nonattainment areas
16. Ultra-low NO <sub>x</sub> burners in commercial, industrial, and institutional boilers	NO <sub>x</sub>	Tentatively Retained for Future Consideration	Developing technology not readily available at this time
17. Ultra-low NO <sub>x</sub> burners in water heaters	NO <sub>x</sub>	Tentatively Retained for Future Consideration	High cost and availability concerns
18. Manure management	VOC, ammonia	Not Retained	NRCS best management practices already encourages manure management. Limited viable options during winter months and treatment options are costly with low control efficiency that would not yield significant ammonia reduction in an ammonia rich inventory
19. Ban testing of back-up generators on red-alert days	VOC, PM <sub>2.5</sub> , NO <sub>x</sub> , SO <sub>x</sub>	Initially Retained	Screened out after review of public comment, rule implementation was more complicated than anticipated, generators cannot be easily re-programmed
20. Prohibit use of cutback asphalt	VOC	Not Retained	Cities and highway administration personnel need stockpile for winter time road repair. Very small inventory.
21. Control limits on aggregate processing operations and asphalt manufacturing	PM <sub>2.5</sub> , NO <sub>x</sub> , SO <sub>x</sub>	Retained	
22. R307-307 Road Salt and Sanding	PM	Retained	Expand current rule to nonattainment areas

EPA published CTGs and Alternative Control Techniques documents (ACTs) for VOCs for a host of emission sources. The CTGs are used to presumptively define VOC RACT. The VOC ACTs describe available control techniques and their cost effectiveness, but do not define presumptive RACT levels as the CTGs do. Therefore, CTG's are given highest priority in rule development.

Where a CTG does not exist for an emission source or where a CTG is so dated that it no longer represents current industry practice, UDAQ considered rules from other states as reference sources.

Additional reference sources include the Ozone Transport Commission (OTC) and the Northeast States for Coordinated Air Use Management.

As noted above, many CTGs were previously adopted into Utah's air quality rules to address ozone nonattainment in Salt Lake and Davis Counties. In conducting this evaluation, consideration was given to whether an expansion of applicability for an existing CTG into additional counties would provide a benefit for PM<sub>2.5</sub>, and whether a strengthening of existing CTG requirements in Salt Lake and Davis Counties would result in an incremental benefit that was economically feasible. Furthermore, EPA has updated some of its existing CTGs and added some new ones to the list.

As part of this SIP, Utah has identified relevant source categories covered by CTGs, and promulgated rules based on the CTGs for reducing emissions from these categories. These rules apply to the following source categories:

- Control of Volatile Organic Emissions from Surface Coating of Cans, Coils, Paper, Fabrics, Automobiles, and Light-Duty Trucks
- Control of Volatile Organic Emissions from Solvent Metal Cleaning
- Control of Volatile Organic Emissions from Surface Coating of Insulation of Magnet Wire
- Control of Volatile Organic Emissions from Graphic Arts
- Control of Volatile Organic Compound Emissions from Wood Furniture Manufacturing Operations
- Control Techniques Guidelines for Industrial Cleaning Solvents
- Control Techniques Guidelines for Flat Wood Paneling Coatings
- Control Techniques Guidelines for Paper, Film, and Foil Coatings
- Control Techniques Guidelines for Large Appliance Coatings
- Control Techniques Guidelines for Metal Furniture Coatings
- Control Techniques Guidelines for Miscellaneous Metal and Plastic Parts Coatings
- Control of Volatile Organic Emissions from Coating Operations at Aerospace Manufacturing and Rework Operations

While most VOC sources are addressed by CTGs, the remaining emission sources must be evaluated by engineering analysis, including an evaluation of rulings by other states including model rules developed by the Ozone Transport Commission. These include VOCs from autobody refinishing, restaurant charbroiling, and phasing out appliance pilot lights.

CTGs for PM<sub>2.5</sub> emissions sources do not exist. RACT for PM<sub>2.5</sub> has been established through information from varied EPA and other state SIP sources. A useful source of data is the AP 42 Compilation of Air Pollutant Emission Factors, first published by the US Public Health Service in 1968. In 1972, it was revised and issued as the second edition by the EPA. The emission factor/control information was applied to fugitive dust and mining strategies.

Table 6.5 shows the effectiveness of the area source SIP control strategy for the Salt Lake City, UT nonattainment area by indicating the quantities of emissions eliminated from the inventory in 2015. Most of these rules became effective January 1, 2014.

<b>Salt Lake City, UT Nonattainment Area</b>				
	<b>2015 lbs/day reduced</b>			
	<b>NOX</b>	<b>PM2.5</b>	<b>SOX</b>	<b>VOC</b>
<b>Area Source Rules</b>				
R307-302, Solid fuel burning	632	5,114	105	6,400
R307-303, Commercial cooking		361		93
R307-309, Fugitive dust		191		
R307-312, Aggregate processing operations		5		
R307-335, Degreasing				2,908
R307-342, Adhesives & sealants				2,112
R307-343, Wood manufacturing				1,146
R307-344, Paper, film & foil coating				1,244
R307-345, Fabric & vinyl coating				2,887
R307-346, Metal furniture coating				95
R307-347, Large appliance coating				3
R307-348, Magnet wire coating				9
R307-349, Flat wood panel coating				73
R307-350 Miscellaneous metal parts coating				2,522
machinery				143
other transportation				447
Special				4
R307-351, Graphic arts				1,917
R307-352, Metal containers				180
R307-353, Plastic coating				1,098
R307-354, Auto body refinishing				2,485
R307-355, Aerospace coatings				718
R307-356, Appliance pilot light	877	4	6	51
R307-357, Consumer products				3,637
R307-361, Architectural coatings				8,038
<b>Grand Totals</b>	<b>1,584</b>	<b>6,276</b>	<b>123</b>	<b>38,964</b>

**Table 6.5, Emissions Reductions from Area Source SIP Controls**

On-road mobile sources:

A decentralized, test-and-repair program was evaluated for Box Elder and Tooele counties within the nonattainment area. For the evaluation, all model year 1968 and newer vehicles would be subject to a biennial test except for exempt vehicles. The program would exempt vehicles less than four years old as of January 1 on any given year from an emissions inspection. Year 1996 and newer vehicles would be subject to an On-Board Diagnostics (OBD) inspection. Year 1995 and older vehicles would be subject to a two-speed idle inspection (TSI). Based on this evaluation, this program was not included because it was determined that implementation of such a program would not affect PM 2.5 concentrations at the controlling monitor (Hawthorne) for the Salt Lake-Ogden-Clearfield nonattainment area. Additional information is provided in the Technical Support Document.

Off-road mobile sources:

Beyond the existing controls reflected in the projection-year inventories and the air quality modeling there are no emission controls that would apply to this source category.

## **Chapter 7 – TRANSPORTATION CONFORMITY**

### **7.1 Introduction**

The federal Clean Air Act (CAA) requires that transportation plans and programs within the Salt Lake City, Utah PM<sub>2.5</sub> nonattainment area conform to the air quality plans in the region prior to being approved by the Wasatch Front Regional Council (WFRC) Metropolitan Planning Organization. Demonstration of transportation conformity is a condition to receive federal funding for transportation activities that are consistent with air quality goals established in the Utah State Implementation Plan (SIP). Transportation conformity requirements are intended to ensure that transportation activities do not interfere with air quality progress. Conformity applies to on-road mobile source emissions from regional transportation plans (RTPs), transportation improvement programs (TIPs), and projects funded or approved by the Federal Highway Administration (FHWA) or the Federal Transit Administration (FTA) in areas that do not meet or previously have not met the National Ambient Air Quality Standards (NAAQS) for ozone, carbon monoxide, particulate matter less than 10 micrometers in diameter (PM<sub>10</sub>), particulate matter 2.5 micrometers in diameter or less (PM<sub>2.5</sub>), or nitrogen dioxide.

The Safe, Accountable, Flexible, Efficient Transportation Equity Act – A Legacy for Users (SAFTEA-LU) and section 176(c)(2)(A) of the CAA require that all regionally significant highway and transit projects in air quality nonattainment areas be derived from a “conforming” transportation plan. Section 176(c) of the CAA requires that transportation plans, programs, and projects conform to applicable air quality plans before being approved by an MPO. Conformity to an implementation plan means that proposed activities must not (1) cause or contribute to any new violation of any standard in any area, (2) increase the frequency or severity of any existing violation of any standard in any area, or (3) delay timely attainment of any standard or any required interim emission reductions or other milestones in any area.

The plans and programs produced by the transportation planning process of the WFRC are required to conform to the on-road mobile source emissions budgets established in the SIP, or absent an approved or adequate budget, required to meet the interim conformity test. Approval of conformity is determined by the FHWA and FTA.

### **7.2 Consultation**

The Interagency Consultation Team (ICT) is an air quality workgroup in Utah that makes technical and policy recommendations regarding transportation conformity issues related to the SIP development and transportation planning process. Section XII of the Utah SIP established the ICT workgroup and defines the roles and responsibilities of the participating agencies. Members of the ICT workgroup collaborated on a regular basis during the development of the PM<sub>2.5</sub> SIP. They also meet on a regular basis regarding transportation conformity and air quality issues. The ICT workgroup is comprised of management and technical staff members from the affected agencies associated directly with transportation conformity.

## **ICT Workgroup Agencies**

- Utah Division of Air Quality (UDAQ)
- Metropolitan Planning Organizations MPOs
  - Cache MPO
  - Wasatch Front Regional Council
  - Mountainland Association of Governments
- Utah Department of Transportation (UDOT)
- Utah Local Public Transit Agencies
- Federal Highway Administration (FHWA)
- Federal Transit Administration (FTA)
- U.S. Environmental Protection Agency (EPA)

During the SIP development process the WFRC coordinated with the ICT workgroup and developed PM<sub>2.5</sub> SIP motor vehicle emissions inventories using the latest planning assumptions and tools for traffic analysis and the EPA-approved Motor Vehicle Emission Simulator (MOVES2010) emissions model. Local MOVES2010 modeling data inputs were cooperatively developed by WFRC and the ICT workgroup using EPA-recommended methods where applicable.

### **7.3 Regional Emission Analysis**

The regional emissions analysis is the primary component of transportation conformity and is administered by the lead transportation agency located in the EPA designated air quality nonattainment area. In December 2009, EPA designated all of Davis and Salt Lake Counties and parts of Box Elder, Tooele, and Weber as the Salt Lake City, Utah PM<sub>2.5</sub> nonattainment area. The Deadlines Rule (signed April 25, 2014) later classified this as a moderate PM<sub>2.5</sub> nonattainment area. The responsible transportation planning organization for the Salt Lake City, UT nonattainment area is the Wasatch Front Regional Council (WFRC).

As a condition to receive federal transportation funding, transportation plans, programs, and projects are required to meet the criteria and procedures for demonstrating and assuring conformity to the applicable implementation plan developed pursuant to Section 110 and Part D of the CAA. The criteria, specified in 40 CFR 93.109, differ based on the action under review and the status of the

implementation plan. The satisfaction of criteria and procedures, for implementation plans submitted under Section 189(a)(1)(B)(ii) of the CAA, which demonstrate the impracticability of demonstrating attainment of the applicable NAAQS by the applicable attainment date, are addressed in paragraph 93.109(g)(4) of the conformity rule. For such implementation plan revisions, it is the interim emissions tests which must be satisfied, as specified in Section 93.119.

#### **7.4 Interim PM<sub>2.5</sub> Conformity Test**

The EPA interim conformity test, for the purposes of this plan revision, will require that NO<sub>x</sub>, VOC, and direct PM<sub>2.5</sub> (elemental carbon, organic carbon, SO<sub>4</sub>, brake and tire wear) emissions from RTPs, TIPs, and projects funded or approved by the FHWA or the FTA not exceed 2008 levels.

VOC is included because UDAQ has identified volatile organic compounds (VOCs) as a PM<sub>2.5</sub> precursor that significantly impacts PM<sub>2.5</sub> concentrations.

The EPA conformity rule presumes that PM<sub>2.5</sub> re-entrained road dust does not need to be included in the interim conformity test unless either the State or EPA decides that re-entrained road dust emissions are a significant contributor to the PM<sub>2.5</sub> nonattainment problem. The UDAQ conducted a re-entrained road dust study that concluded that PM<sub>2.5</sub> re-entrained road dust emissions are negligible in the Salt Lake City, Utah PM<sub>2.5</sub> nonattainment area, and thus meet the criteria of 40 CFR 93.102(b)(3). EPA Region 8 reviewed the study and concurred with the UDAQ's findings.

## **Chapter 8 – REASONABLE FURTHER PROGRESS**

### **8.1 Introduction**

Clean Air Act Section 172(c)(2) requires that plans for nonattainment areas “shall require reasonable further progress (RFP).” The definition of RFP is given in Section 171 of the CAA. It means “such annual incremental reductions in emissions of the relevant air pollutant as are required by this part or may reasonably be required by the Administrator for the purpose of ensuring attainment of the applicable national ambient air quality standard by the applicable date.”

In general terms, the goal of these RFP requirements is for areas to achieve generally linear progress toward attainment, as opposed to deferring implementation of all measures, where possible, until the end.

The pollutants to be addressed in the RFP plan are those pollutants that are identified for purposes of control measures in the attainment plan: PM<sub>2.5</sub>, SO<sub>2</sub>, NO<sub>x</sub>, and VOC.

### **8.2 Moderate Area Planning Requirements**

Within the context of the moderate area planning requirements given in Subparts 1 and 4 of the CAA, RFP must be considered in light of the attainment date as well as the date by which all RACT and RACM must be implemented. The attainment date for all three of Utah’s moderate PM<sub>2.5</sub> nonattainment areas was established in EPA’s Deadlines Rule. That date is December 31, 2015. The deadline for implementation of all RACT and RACM is described in paragraph 189(a)(1)(C) as four years from the date these areas were designated nonattainment. That date for implementation of RACM was thus December 14, 2013.

There are other moderate area planning requirements in Subpart 4 that relate to the showing of RFP. Paragraph 189(a)(1)(B) requires “either (i) a demonstration (including air quality modeling) that the plan will provide for attainment by the applicable attainment date; or (ii) a demonstration that attainment by such date is impracticable.”

This plan demonstrates the latter; that despite the implementation of all reasonably available controls, the area still will not attain the 2006, 24-hour standard for PM<sub>2.5</sub> by December 31, 2015.

Paragraph 189(c) discusses “milestones ... which demonstrate reasonable further progress ... toward attainment by the applicable date,” but these are to be submitted with “plan revisions demonstrating attainment.” Since this plan does not demonstrate attainment, the RFP showing will instead be addressed herein, as part of this plan revision.

### **8.3 RFP for the Salt Lake City, UT Nonattainment Area**

Past Guidance on RFP, for showing generally linear progress towards attainment by the applicable attainment date, has described a straight line with a downward trend, ending at the attainment date and representing, there, a level of emissions that is consistent with attainment of the applicable NAAQS.

Since this plan does not show attainment of the standard by the attainment date (December 31, 2015), and furthermore does not show when or how attainment might be achieved, the “reductions in emissions of the relevant air pollutant as are required by this part” are left undefined. In terms of the straight line, the drop of the line, over its length, is an unknown quantity.

Furthermore, since  $PM_{2.5}$  has a secondary component born of non-linear chemical reactions involving precursor gasses, it is not practical to extrapolate what reductions in which emissions would be necessary to attain the standard at some future date.

The magnitude then, for this plan revision, of emissions reductions required for a showing of RFP, must have the meaning of those that “may reasonably be required by the Administrator.”

Since RFP considers the overall magnitude of emissions reductions “for the purpose of ensuring attainment ... by the applicable date,” it is also necessary to define a period of time over which this determination will be made.

The starting point for evaluating RFP should be the baseline year used in the modeling analysis. This is a year (2010) selected to coincide with the period used to establish the monitored design value for the modeling analysis; a period in which the area is violating the applicable NAAQS.

Thus, the magnitude of emissions reductions should be evaluated over a period spanning from 2010 through 2015, though it should be recognized that meaningful SIP controls were not required until 2014.

Quantitatively, the following assessment of emissions and incremental emissions reductions in Table 8.1 will show that RFP is met using the criteria discussed above:

<b>Reasonable Further Progress</b>						
<b>Salt Lake City, UT PM2.5 Nonattainment Area</b>						
<b>*Emissions / Year</b>	<b>2010</b>	<b>2015</b>			<b>Difference</b>	<b>RFP</b>
		projected with growth and controls				Annualized Difference
<b>PM2.5</b>	19.6		18.8		0.8	0.2
<b>NOx</b>	160.5		140.8		19.7	3.9
<b>SO2</b>	12.8		18.3		-5.5	-1.1
<b>VOC</b>	130.0		102.5		27.5	5.5
<b>Plan precursors</b>	303.3		261.6		41.7	8.3
<b>Total</b>	323.0		280.5		42.5	8.5
<b>**Concentration (ug/m3)</b>	42		37		5.0	1.0
* Emissions are presented in tons per average winter day						
**Value for 2010 is Baseline design value for the Hawthorne monitor						

**Table 8.1, Reasonable Further Progress in the Salt Lake City, UT nonattainment area**

In addition to the emissions totals, the table also includes the 2010 baseline design value for the controlling monitor in the nonattainment area (Hawthorne) and the predicted PM<sub>2.5</sub> concentration in 2015. These concentrations are presented as another metric to establish progress toward meeting the 24-hour standard.

#### Control Measures

The inventory for 2015 “with growth and controls” reflects the implementation of all the reasonably available control measures and reasonably available control technologies identified in this plan (up to and beyond the attainment date<sup>1</sup>), as well as all pre-existing control measures. As such, this inventory takes into account all controls that “may reasonably be required by the Administrator.”

<sup>1</sup> The RACT measures for stationary sources include controls to be implemented past the implementation date of December 14, 2013. For reasons articulated in section 6.6 of this plan, these measures were retained in transitioning from the planning requirements of only Subpart 1 to those also including Subpart 4. These additional measures are not relied upon for a showing of attainment. Rather, their inclusion in the modeling analysis underscores that attainment by December 31, 2015 is impracticable. For the purposes of RFP however, it is not appropriate to include the effectiveness of control measures with implementation dates not required until after the attainment date (December 31, 2015.) Thus, the 2015 emissions shown in Table 8.1 differ from the emissions shown in Table 4.2 by the amount of these controls. Nevertheless, from a qualitative standpoint, their inclusion in the Emission Limitations portion of this plan also underscores the fact that this plan continues to require measures to further the progress toward attainment, even beyond the applicable attainment date.

For a complete discussion of RACM & RACT, and the control measures factored into the modeled demonstration for 2015, see Chapter 6 of the Plan.

## Chapter 9 – CONTINGENCY MEASURES

### 9.1 Background

Consistent with section 172(c)(9) of the Act, the State must submit in each attainment plan specific contingency measures to be undertaken if the area fails to make reasonable further progress, or fails to attain the PM<sub>2.5</sub> NAAQS by its attainment date. The contingency measures must take effect without significant further action by the State or EPA.

Nothing in the statute precludes a State from implementing such measures before they are triggered, but the credit for a contingency measure may not be used in either the attainment or reasonable further progress demonstrations.

The SIP should contain trigger mechanisms for the contingency measures, specify a schedule for implementation, and indicate that the measures will be implemented without further action by the State or by EPA.

The CAA does not include the specific level of emission reductions that must be adopted to meet the contingency measures requirement under section 172(c)(9). Nevertheless, in the preamble to the Clean Air Fine Particulate Rule (see 72 FR 20643) EPA recommends that the “emissions reductions anticipated by the contingency measures should be equal to approximately 1 year’s worth of emissions reductions necessary to achieve RFP for the area.”

### 9.2 Contingency Measures and Implementation Schedules for the Nonattainment Area

The following measures have been set aside for contingency purposes:

Woodburning Control – As part of the control strategy for the SIP, rule R307-302 has been amended to change the no-burn call from 35 µg/m<sup>3</sup> to 25 µg/m<sup>3</sup>. Credit for this change is included in the modeled attainment demonstration as well as the RFP demonstration. However, R307-302 also includes a mechanism to further revise the no-burn call to only 15 µg/m<sup>3</sup> should a contingency situation arise. The benefit of this rule is to prevent a buildup of particulate matter due to woodsmoke during periods of poor atmospheric mixing which typically precede exceedances of the 24-hour PM<sub>2.5</sub> NAAQS. This rule has been adopted, and can take effect immediately if so required.

This contingency measure will be triggered by an EPA determination that: 1) the area has failed to make RFP; or 2) has failed to attain the NAAQS by the applicable attainment date.

### 9.3 Conclusions

Control measures developed to meet increasingly stringent ozone and fine PM<sub>2.5</sub> standards in Utah's urbanized areas have likewise become increasingly stringent, and still it is a challenge to attain the 2006, PM<sub>2.5</sub> NAAQS. This leaves little room for additional reductions that can be set aside as contingency measures.

The control strategy analysis summarized in Chapter 6 shows that stationary sources already meet or exceed RACT, and represent at most about 20% of the emissions contributing to excessive PM<sub>2.5</sub> concentrations during winter. By contrast, area sources and on-road mobile sources contribute most of the emissions, but further emission control in these categories extends beyond the authorities of UDAQ. The most meaningful reductions in future emissions of VOC, an important PM<sub>2.5</sub> precursor, will likely result from additional restrictions of VOC in consumer products, and from what will likely result from Tier 3 of the federal motor vehicle control program.